



**nobis**

## **MEMORANDUM**

**To:** EPA  
**From:** J. Lambert, J. Brunelle, C. Woods, T. DeLong  
**Subject:** Olin – Plant B/East Ditch Risk Evaluation V2  
**Date:** August 27, 2019

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Nobis Group® (Nobis) has developed this Technical Memorandum (Memo) as requested by the U.S. Environmental Protection Agency (EPA) to summarize existing data and provide an initial evaluation of the potential human health and ecological risks mitigated by operations at the former Plant B.

Plant B currently serves as a groundwater treatment system to collect light non-aqueous phase liquid (LNAPL) and control groundwater flow through and downgradient to the Plant B area. Olin has requested permission from EPA to shut down the current LNAPL recovery/groundwater extraction system. Cessation of pumping may allow groundwater to migrate to the East Ditch adjacent to the Plant B area and to the South Ditch via groundwater migration and the confluence of these waterways.

### **1.0 HISTORY**

Historical employee interviews have indicated that spills occurred near Plant B, but documentation of these spills have not been identified. According to Conestoga-Rovers & Associates ([CRA], 1993) spilled materials included diisobutylene, diphenylamine, dioctylphthalate, dioctyldiphenylamine, and fuel oil.

As early as 1973, the Massachusetts Department of Environmental Protection (MassDEP) contacted Stepan Chemical Corporation regarding a seep of an oily substance into the East Ditch adjacent to the Plant B tank farm (Smith, 1997). The oil contained a high percentage of bis(2-ethylhexyl)phthalate (BEHP) and lesser amounts of n-nitrosodiphenylamine (NDPA), di-n-octylphthalate, and trimethylpentenes (TMPs). Originally the Plant B tank farm was constructed on-grade, with no perimeter dike or spill containment system; however, Olin installed a secondary containment system consisting of a concrete base slab and perimeter curbing after purchasing the facility in 1980 (CRA, 1993).

Olin has operated a groundwater recovery/treatment system to contain oil seepage to the East Ditch since 1981. The system was designed to create a cone of depression in groundwater to prevent the migration of and capture LNAPL. According to MACTEC (MACTEC, 2005), the system has been modified twice, including the following:

- In 1984, the initial 4 recovery wells (CRA, 1993) were replaced by 5 wells.
- In 1998, those 5 wells were replaced by a 3-well recovery system (IW-11, IW-12, and IW-13) to address well fouling.

The system removes iron via pH adjustment, ammonia with breakpoint chlorination, and organics with activated carbon. According to MACTEC (MACTEC, 2007), LNAPL had dropped substantially since 2000, as documented by the following table:

Annual LNAPL Recovery from 2000-2007

Year	2000	2001	2002	2003	2004	2005	2006	2007
Number of Months	6	12	12	12	12	12	12	3
LNAPL Recovered (Gallons)	35.2	34.9	13.1	6.4	3.7	1.8	1.5	0.4

Based on this information, Olin has requested permission from EPA to shut down the Plant B treatment system.

## 2.0 HUMAN HEALTH RISKS

Bluestone Environmental Group, Inc. (Bluestone) prepared revised risk tables for construction workers and trespassers potentially exposed to shallow groundwater or surface water if Plant B were to be shut down and current groundwater concentrations were to migrate to the East Ditch or shallow groundwater along the East Ditch. The risk evaluation included groundwater data from the wells shown on Figure 1.

Utility workers were assumed to contact shallow groundwater in trenches 20 days per year, 8 hours per day, averaged over 1 month of exposure. Adolescent trespassers were assumed to contact surface water in east ditch 26 days per year averaged over 10 years of exposure. Based on this evaluation, the risks are as follows:

- Utility worker: total cancer risk of 3.7E-08 (below risk target), noncancer total hazard index (HI) of 44 (significantly exceeds risk target). The primary drivers for the noncancer HI are 1,1-biphenyl (total HI of 7.0) and diphenyl ether (total HI of 36). The primary exposure route was inhalation (HI of 43).
- Trespasser: total cancer risk of 4.3E-06 (below risk target), noncancer total HI of 0.15 (below risk target).

The human health risk evaluation determined that contaminants that may enter East Ditch after Plant B shutdown may pose an unacceptable non-cancer risk to workers. Tables 1-1 through 1-10 and RAGS Table 4.1 and 4.2 (attachment A) provide supporting calculations.

## **3.0 ECOLOGICAL RISKS**

Ecological evaluations are described in the following subsections.

### **3.1 Environmental Setting**

Formerly the East Ditch was the receiving body for water discharged from Plant B. EPA's 1986 National Pollutant Discharge Elimination System (NPDES) permit fact sheet (EPA, 1986) names the East Ditch as an unnamed tributary to Halls Brook and classifies it as a Class C waterway. EPA's March 9, 1987 permit (EPA, 1987) also states that East Ditch is a tributary to Halls Brook.

In addition to EPA's determination, the MassDEP surface water regulations (MassDEP, 2013) define rivers and streams as "Waterbodies contained within a channel (naturally or artificially created) which periodically or continuously contains flowing water or forms a connecting link between two bodies of standing water." Section 4.06 (Basin Classifications and Maps) states that unless otherwise designated in 314 CMR 4.06 or unless otherwise listed in the tables to 314 CMR 4.06, other waters are Class B and presumed High Quality Waters for inland waters. Class B waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions. The regulation also states that all surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife.

The Final Interim Response Steps Work Plan (IRSWP) (MACTEC, 2008, page 3-3) acknowledged that the East Ditch surface water adjacent to Plant B is the primary receptor of groundwater, and that some groundwater is expected to discharge to water within East Ditch. The IRSWP states

that Olin will monitor groundwater close to the East Ditch and East Ditch surface water for VOCs, SVOCs, VPH, and ammonia during any reduction in pumping,

The IRSWP also included objectives for pumping modifications including “no adverse impacts on surface water quality in the East Ditch” and “no visually observable adverse impacts to aquatic life in the East Ditch” (page 3-21). This suggests that Olin has previously acknowledged that the East Ditch is an ecological receptor that requires some degree of concern and limitations on impacts.

AMEC performed a Screening Level Ecological Risk Assessment (SLERA) for the East Ditch in the 2015 OU1/OU2 RI (AMEC, 2015 - as Appendix N, Attachment 7). The SLERA characterized the East Ditch as follows:

- Channel alteration: poor
- Channel sinuosity: poor
- Sediment deposition: poor
- Epifaunal substrate/available cover: marginal or poor
- Pool substrate: not scored (no pools/riffles observed)
- Pool variability: poor
- Channel flow status: poor or marginal
- Bank stability: eastern: optimal (ballasted), western bank: suboptimal
- Vegetative cover: eastern bank: poor, western bank: marginal
- Riparian vegetative zone width: eastern bank: poor, western bank: poor

Olin’s functions and values assessment concluded that the East ditch provides little or no habitat of value. This conclusion was used in part to rule out ecological risks from contaminants remaining from the original screening (VOCs, SVOCs, metals, chloride, ammonia, sulfate, and hydrazine).

Based on the available information, the East Ditch was considered to have sufficient value to be protected from adverse impacts prior to 2015. Evidence suggests that while East Ditch currently does not provide habitat of value, adverse impacts should not be discounted. Therefore, remedial



action objectives for the East Ditch should include prevention of contamination and restoration to the extent practicable.

### **3.2 Comparison to Criteria - Ammonia**

Bluestone compared ammonia concentrations in groundwater to the chronic Aquatic Life Ambient Water Quality Criteria (AWQC) values, as presented in the 2013 update of the freshwater ammonia criteria (EPA, 2013). See Table 2-1.

Higher temperatures and pH increase ammonia toxicity in freshwater systems. Throughout the temperature range, the 2013 chronic benchmark value magnitude is determined primarily by the effects on freshwater mollusks. The chronic benchmark value duration is a 30-day rolling average, with an additional restriction that the highest 4-day average within the 30 days be no greater than 2.5 times the chronic criterion magnitude.

Ammonia concentrations in groundwater samples from several wells exceed the surface water criteria for ammonia using a temperature of 20°C or 30°C. Sample locations include:

- B-03 (prior to 2010 only)
- GW-101 (including most recent sample in database – 2016)
- GW-13 (prior to 1990)
- GW-14 (including most recent sample in database – 2010)
- GW-15 (including most recent sample in database – 2010)
- GW-16 (including most recent sample in database – 2013)
- GW-52S (including most recent sample in database – 2010)
- IW-1 (including most recent sample in database – 2003)
- IW-6 (prior to 2008)
- IW-10 (including most recent sample in database – 2016)
- IW-11 (including most recent sample in database – 2006)
- IW-12 (including most recent sample in database – 2006)
- IW-13 (including most recent sample in database – 2006)

- P5 (including most recent sample in database – 2003)

The highest concentrations were detected in GW-15, with values more than 2 orders of magnitude (OOM) above the highest ecological screening criterion. Concentrations have generally decreased since the max value was detected in 1987.

Table 2-2 compares the pH and temperature values for both surface water and groundwater. The average pH for East Ditch (limited sampling) is similar to the average pH for South Ditch and very close to the pH used for the ecological criteria for ammonia. The average groundwater pH and temperature values are approximately 6 and 11°C, respectively. A higher ammonia value may be appropriate to evaluate risk for pore water and water entering the East Ditch; however, pH and temperature may be affected by dilution with existing surface water.

The initial ecological screening indicates that ammonia concentrations that may enter East Ditch after Plant B shutdown may pose an unacceptable ecological risk.

### **3.2 Comparison to Criteria – All Results**

Table 2-3 compares the detected groundwater concentrations to the National Recommended Water Quality Criteria (NRWQC), for analytes for which NRWQC are available. For this comparison, the same data set was used for both the human health and ecological risk evaluations (Table 1-10) that included only data from the RI and later (after 2009). Full results are provided as Attachment B. The following analytes exceed the NRWQC:

- Aluminum: 8 of 14 total aluminum samples exceeded the NRWQC. The single dissolved aluminum sample also exceeded the NRWQC. The average detected concentration was 893 µg/L, approximately one OOM above the NRWQC.
- Iron: 3 of 14 total iron samples exceeded the NRWQC (average detected concentration of 1,498 µg/L). 16 of 38 dissolved iron samples exceeded the NRWQC (average detected concentration of 3,778 µg/L). Both averages exceed the NRWQC for iron (1,000 µg/L).
- Lead: 2 of 14 total lead samples exceeded the NRWQC. The single dissolved lead sample did not exceed the NRWQC. The average detected concentration was 3.3 µg/L, slightly above the NRWQC.
- Zinc: 1 of 14 total zinc samples exceeded the NRWQC. The single dissolved zinc sample did not exceed the NRWQC. The average detected concentration was 34 µg/L, below the NRWQC.

- Ammonia: 21 samples exceeded the NRWQC based on a temperature of 30°C and pH of 7. 14 samples exceeded the higher NRWQC based on a temperature of 20°C and pH of 7. The average concentration was 13.5 mg/L, almost one OOM above the higher NRWQC value.
- Chloride: 1 sample exceeded the NRWQC. The average detected concentration was 48 mg/L, below the NRWQC.

The screening of other criteria suggests that in addition to ammonia, relatively recent concentrations of metals and chloride (post 2009) exceed the NRWQC and may pose risks to ecological receptors in the East Ditch. Contaminants with average values exceeding the NRWC include ammonia, aluminum, iron, and lead.

#### **4.0 REFERENCES**

AMEC, 2015. Final Remedial Investigation Report, Operable Unit 1 & Operable Unit 2, Olin Chemical Superfund Site, Wilmington, Massachusetts. July 24.

CRA, 1993. Comprehensive Site Assessment Phase II Field Investigation Report. Wilmington Facility, Wilmington, MA. June.

EPA, 1986. Fact Sheet: Draft National Pollutant Discharge Elimination System (NPDES) Permit to Discharge to Waters of the United States. October 8.

EPA, 1987. Authorization to Discharge Under the National Pollutant Discharge Elimination System. March 9.

EPA, 2013. Aquatic Life Ambient Water Quality Criteria for Ammonia-Freshwater 2013. Office of Water. EPA 822-R-18-002. April.

MACTEC, 2005. Immediate Response Action Status Report (December 2004 through May 2005), Plant B Groundwater Recovery/Treatment System and Air Sparge/Soil Vapor Extraction System. August.

MACTEC, 2007. Draft Focused Remedial Investigation Report, Olin Chemical Superfund Site, 51 Eames Street, Wilmington, Massachusetts. October.

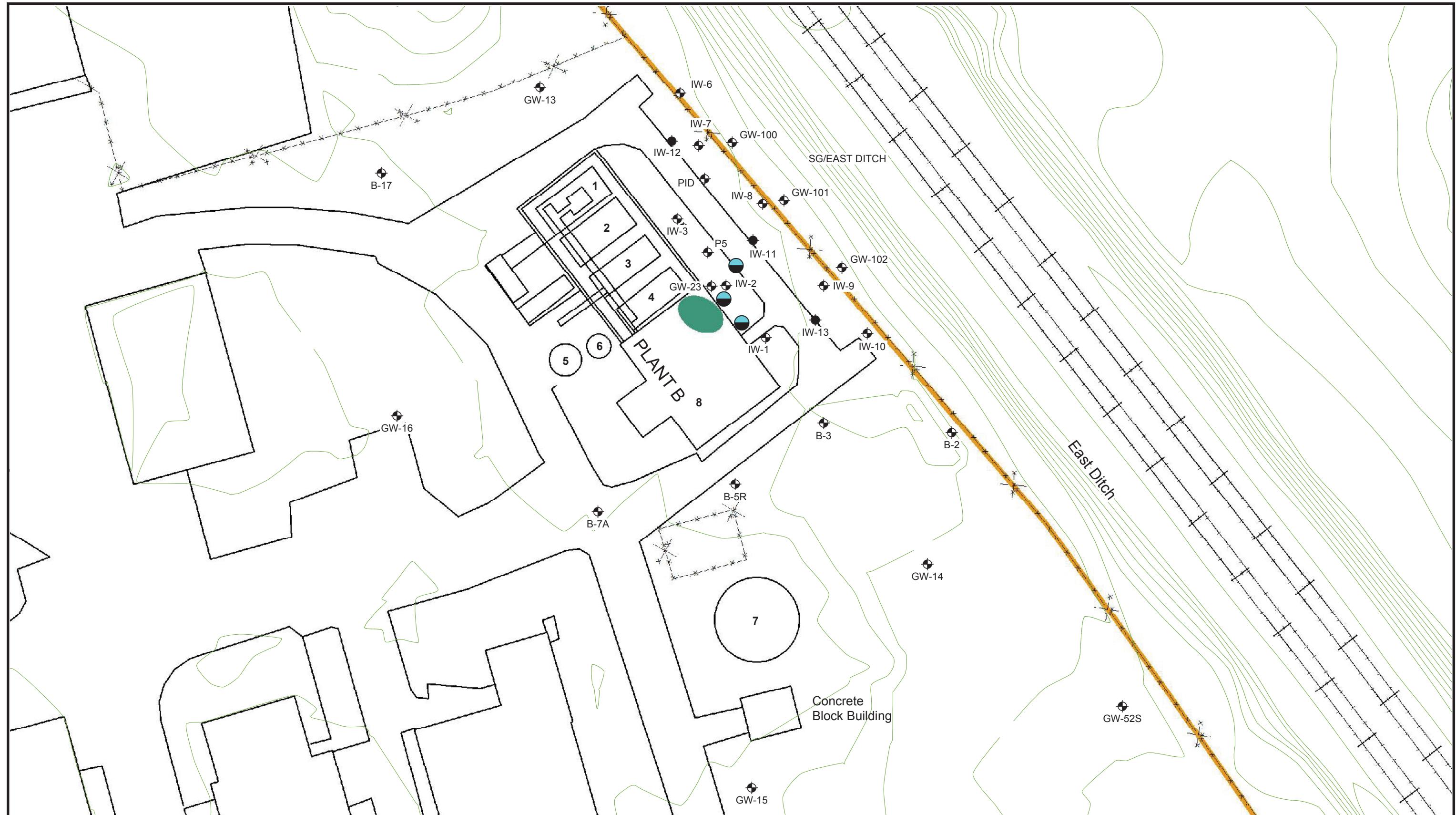


MACTEC, 2008. Final Interim Response Steps Work Plan, Olin Chemical Superfund Site, 51 Eames Street, Wilmington, Massachusetts. August 8.

MassDEP, 2013. 314 CMR 4.00: Massachusetts Surface Water Quality Standards. Revised December 6.

Smith, 1997. Supplemental Phase II Report, Wilmington, Massachusetts Site, Olin Corporation. June.

Figure 1: Plant B Well Locations



Tank #1 - Receives gravity overflow from Tank 2 and allows for further settling  
 Tank #2 - Caustic addition and initial iron drop-out  
 Tank #3 & #4 - Overnight holding tank for treated water  
 Tank #5 - Pre-carbon hold tank  
 Tank #6 - Residence tank  
 Tank #7 - Raw water (pH adjusted)  
 Tank #8 - Pre-carbon transfer  
 Tank #9 - Day discharge to NPDES Outfall 002

Legend

- ◆ Monitoring Well
- Groundwater Recovery Well
- Elevation Contours
- LNAPL Recovery Well (Mechanical LNAPL Removal)
- Presumed location of residual LNAPL under Plant B foundation



Wood  
Environment & Infrastructure Solutions  
271 Mill Road  
Chelmsford, MA 01824

N  
0 15 30 60  
Feet

Figure 3.2-1  
Alternative LNAPL3 Conceptual Design

Interim Action Feasibility Study  
Olin Chemical Superfund Site  
Wilmington, Massachusetts

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**Table 1-1**  
**Summary of Analytes Detected in Groundwater**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Analyte	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency <sup>a</sup>	Detection Limits <sup>b</sup>		EPA Regional Screening Level <sup>c</sup> (RSL)	Ratio of Maximum Concentration to EPA RSL	Contaminant of Potential Concern <sup>d</sup> (COPC)
<b>Organics</b>										
1,1,2-Trichloro-1,2,2-trifluoroethane	0.81	0.81	µg/L	OC-GW-101-XXX-20101011	1/14	1.0	-	2.0	1000	n
1,1'-Biphenyl	0.79	27	µg/L	OC-GW-15-XXX-20101012	3/14	4.5	-	4.9	0.083	n
1-Pentene, 2,4,4-trimethyl-	0.50	1400	µg/L	OC-IW-6-20141105	32/50	1.0	-	1.0	NA	NA
2,4,4-Trimethyl-2-Pentene	0.73	350	µg/L	OC-IW-6-20161206	32/50	1.0	-	1.0	NA	No
Aniline	0.68	1.0	µg/L	OC-GW-101-XXX-20100512	2/14	4.5	-	4.9	13	c
Benzene	2.0	2.5	µg/L	OC-IW-6-20141105	3/50	1.0	-	100	0.46	c
Benzoic Acid	1.1	1.1	µg/L	OC-GW-14-XXX-20101013	1/7	4.5	-	4.5	7500	n
Bis(2-ethylhexyl)phthalate	0.44	200	µg/L	IW-13-20130906	19/53	0.67	-	52	5.6	c
C5-C8 Aliphatics	8.1	1900	µg/L	OC-IW-6-20161206	22/42	5.0	-	200	130	15
C9-C12 Aliphatics	2.9	55	µg/L	OC-IW-6-20131120	5/42	5.0	-	200	130	0.42
C9-C10 Aromatics	0.54	14	µg/L	OC-GW-16R-20130510	5/32	5.0	-	1000	3.3	4.2
C11-C22 Aromatics	140	250	µg/L	OC-GW-15-XXX-20101012	3/6	91	-	91	3.3	76
Caprolactam	0.86	0.86	µg/L	OC-GW-15-XXX-20100513	1/7	4.5	-	4.9	990	n
Carbon disulfide	1.6	1.6	µg/L	OC-GW-101-XXX-20101011	1/14	10	-	20	81	n
Di-N-Butylphthalate	0.68	0.93	µg/L	OC-GW-15-XXX-20101012	3/14	0.58	-	4.5	90	n
Diphenylamine	67	67	µg/L	OC-GW-101-XXX-20100512	1/6	4.5	-	4.9	130	n
Diphenyl ether	2.4	260	µg/L	OC-GW-15-XXX-20101012	6/14	4.5	-	4.9	0.083	n
Ethylbenzene	0.35	3.3	µg/L	OC-IW-6-20141105	4/50	1.0	-	100	1.5	c
EPH, Total	140	250	µg/L	OC-GW-15-XXX-20101012	3/6	91	-	91	NA	NA
Hydrazine	0.10	0.095	µg/L	OC-GW-52S-XXX-20101013	1/6	0.079	-	0.20	0.0011	c
Kempore	320	990	µg/L	OC-GW-52S-XXX-20100513	2/6	1000	-	1000	2000	n
Methyl tert-butyl ether	1.0	8.7	µg/L	OC-IW-6-20161206	6/50	1.0	-	100	14	c
m,p-Xylene	1.7	1.7	µg/L	OC-B-03-20131120	1/50	2.0	-	200	19	n
N-Nitrosodimethylamine	0.0020	0.047	µg/L	OC-GW-13-XXX-20101012	4/14	0.0019	-	0.0020	0.00011	c
N-Nitrosodiphenylamine	0.34	340	µg/L	OC-GW-101-20111109	25/50	4.5	-	52	12	c
Nonylphenol	2.7	2.9	µg/L	OC-GW-52S-XXX-20101013	2/6	4.8	-	4.8	NA	NA
o-Xylene	0.31	13	µg/L	OC-IW-6-20101118	7/50	1.0	-	100	19	n
Perchlorate	1.1	1.9	µg/L	OC-GW-52S-XXX-20100513	2/6	1.0	-	1.0	1.4	n
Phenol	0.84	0.84	µg/L	OC-GW-15-XXX-20100513	1/14	4.5	-	4.9	580	n
Tetrahydrofuran	3.2	35	µg/L	OC-GW-14-XXX-20101013	2/14	10	-	20	340	n
Toluene	0.58	23	µg/L	OC-IW-6-20141105	7/50	1.0	-	100	110	n
VPH, Total	170	1600	µg/L	OC-IW-6-20101118	5/16	50	-	200	NA	NA

**Table 1-1**  
**Summary of Analytes Detected in Groundwater**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Analyte	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency <sup>a</sup>	Detection Limits <sup>b</sup>		EPA Regional Screening Level <sup>c</sup> (RSL)	Ratio of Maximum Concentration to EPA RSL	Contaminant of Potential Concern <sup>d</sup> (COPC)		
<b>Inorganics</b>												
Aluminum	19	5200	µg/L	OC-GW-15-XXX-20101012	12/15	100	-	100	2000	n	2.6	Yes
Antimony	1.5	2.6	µg/L	OC-B-07-A-XXX-20101011	4/15	6.0	-	6.0	0.78	n	3.3	Yes
Arsenic	0.59	18	µg/L	OC-GW-101-XXX-20101011	8/15	1.0	-	10	0.052	c	346	Yes
Barium	10	150	µg/L	OC-GW-101-XXX-20101011	15/15	NA		380	n	0.39	No	
Beryllium	0.35	0.35	µg/L	OC-GW-15-XXX-20101012	1/15	0.27	-	1.0	2.5	n	0.14	No
Cadmium	0.14	0.37	µg/L	OC-GW-13-XXX-20101012	8/15	0.22	-	1.0	0.92	n	0.40	No
Calcium	2800	64000	µg/L	OC-GW-101-XXX-20101011	15/15	NA		NUT	NA		No	
Chromium	6.2	56	µg/L	OC-GW-15-XXX-20101012	5/15	0.71	-	7.4	2200	n	0.025	No
Chromium-Hexavalent	0.71	1.0	µg/L	OC-GW-52S-XXX-20100513	2/6	1.0	-	1.0	0.035	c	27	Yes
Cobalt	2.6	12	µg/L	OC-GW-101-XXX-20101011	6/15	10	-	10	0.6	n	20	Yes
Copper	3.0	31	µg/L	OC-GW-15-XXX-20100513	5/15	2.3	-	67	80	n	0.39	No
Iron	17	16000	µg/L	OC-IW-6-20161206	42/51	50	-	100	1400	n	11	Yes
Lead	1.5	8.7	µg/L	OC-GW-14-XXX-20100513	6/15	5.0	-	5.0	15	0.58		No
Magnesium	280	11000	µg/L	OC-GW-101-XXX-20101011	15/15	NA		NUT	NA		No	
Manganese	6.2	540	µg/L	OC-GW-101-XXX-20101011	15/15	NA		43	n	13	Yes	
Mercury	0.17	0.17	µg/L	OC-GW-52S-XXX-20101013	1/15	0.085	-	0.35	0.063	n	2.7	Yes
Nickel	1.2	26	µg/L	OC-GW-15-XXX-20101012	13/15	10	-	10	39	n	0.67	No
Potassium	900	5200	µg/L	OC-GW-101-XXX-20101011	10/15	1700	-	4000	NUT	NA		No
Sodium	1200	240000	µg/L	OC-GW-101-XXX-20101011	15/15	NA		NUT	NA		No	
Vanadium	1.7	280	µg/L	OC-GW-52S-XXX-20101013	10/15	10	-	10	8.6	n	33	Yes
Zinc	8.7	130	µg/L	OC-GW-13-XXX-20101012	10/15	50	-	50	600	n	0.22	No

<sup>a</sup>Number of sampling locations at which analyte was detected compared with total number of sampling locations.

<sup>b</sup>Based on nondetected samples.

<sup>c</sup>USEPA Residential values RSL Summary Table, May 2019.

- Total Petroleum Hydrocarbons (Aliphatic Low) value used as a surrogate for C5-C8 Aliphatics and C9-C12 Aliphatics.

- Total Petroleum Hydrocarbons (Aromatic Low) value used as a surrogate for C9-C10 Aromatics and C11-C22 Aromatics.

<sup>d</sup>Analytes considered COPC if the ratio of maximum concentration to EPA RSL ≥ 1.

c = Cancer based, target risk equals 1E-06.

µg/L = Microgram/liter.

ND = Not detected.

NA = Not available.

n = Noncancer based, target hazard quotient equals 0.1.

NUT = Essential nutrient.

**Table 1-2**  
**Summary of Exposure Point Concentrations for COPCs in Groundwater**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Contaminant of Potential Concern (COPC)	95% Upper Concentration Limit (UCL) ( $\mu\text{g}/\text{L}$ )	Maximum Detected Concentration ( $\mu\text{g}/\text{L}$ )	Exposure Point Concentration (EPC)		<b>Rationale</b>
			Value ( $\mu\text{g}/\text{L}$ )	Statistic	
1,1'-Biphenyl	NC	27	27	Maximum	See footnote
Benzene	NC	2.5	2.5	Maximum	See footnote
Bis(2-ethylhexyl)phthalate	26	200	26	95% KM (Chebyshev) UCL	ProUCL Recommendation
C5-C8 Aliphatics	418	1900	418	Gamma Adjusted KM-UCL	ProUCL Recommendation
C9-C10 Aromatics	2.6	14	2.6	KM H-UCL	ProUCL Recommendation
C11-C22 Aromatics	NC	250	250	Maximum	See footnote
Diphenyl ether	148	260	148	Gamma Adjusted KM-UCL	ProUCL Recommendation
Ethylbenzene	0.67	3.3	0.67	95% KM (t) UCL	ProUCL Recommendation
Hydrazine	NC	0.095	0.095	Maximum	See footnote
N-Nitrosodimethylamine	0.013	0.047	0.013	95% KM (t) UCL	ProUCL Recommendation
N-Nitrosodiphenylamine	77	340	77	97.5% KM (Chebyshev) UCL	ProUCL Recommendation
Perchlorate	NC	1.9	1.9	Maximum	See footnote
Aluminum	895	5200	895	95% KM Bootstrap t UCL	ProUCL Recommendation
Antimony	2.3	2.6	2.3	95% KM (t) UCL	ProUCL Recommendation
Arsenic	5.4	18	5.4	95% KM (t) UCL	ProUCL Recommendation
Chromium-Hexavalent	NC	0.96	0.96	Maximum	See footnote
Cobalt	5.6	12	5.6	95% KM (t) UCL	ProUCL Recommendation
Iron	6122	16000	6122	97.5% KM (Chebyshev) UCL	ProUCL Recommendation
Manganese	266	540	266	95% Chebyshev (Mean, Sd) UCL	ProUCL Recommendation
Mercury	NC	0.17	0.17	Maximum	See footnote
Vanadium	157	280	157	95% KM Bootstrap t UCL	ProUCL Recommendation

$\mu\text{g}/\text{L}$  = Micrograms per liter.

Note: Maximum detected concentration used as the EPC in instances where total samples were less than or equal to 10 and/or there were less than 4 detects. If the sample size was sufficient, the ProUCL recommendation was used.

**Table 1-3**  
**Exposure Doses and Cancer Risks for Future Utility Worker Exposure to Shallow Groundwater in Construction Trenches**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Contaminant of Potential Concern (COPC)	Exposure Point Concentration (EPC) <sup>a</sup> (µg/L)	Exposure Doses			Toxicity Values			Cancer Risks			
		Ingestion (mg/kg-day)	Dermal Contact (mg/kg-day)	Inhalation (VOCs) (µg/m³)	Oral CSF (mg/kg-day) <sup>-1</sup>	Dermal CSF (mg/kg-day) <sup>-1</sup>	Inhalation URF (µg/m³) <sup>-1</sup>	Ingestion	Dermal Contact	Inhalation (VOCs)	Total
1,1'-Biphenyl	27	1.1E-09	7.5E-08	3.2E-03	8.0E-03	8.0E-03	NA	8.5E-12	6.0E-10	NA	6.1E-10
Benzene	2.5	9.8E-11	8.9E-10	4.9E-04	5.5E-02	5.5E-02	7.8E-06	5.4E-12	4.9E-11	3.8E-09	3.9E-09
Bis(2-ethylhexyl)phthalate	26	1.0E-09	2.0E-06	NA	1.4E-02	1.4E-02	2.4E-06	1.4E-11	2.8E-08	NA	2.8E-08
C5-C8 Aliphatics <sup>b</sup>	418	1.6E-08	2.3E-06	7.8E-02	NA	NA	NA	NA	NA	NA	---
C9-C10 Aromatics <sup>c</sup>	2.6	1.0E-10	9.2E-10	5.0E-04	NA	NA	NA	NA	NA	NA	---
C11-C22 Aromatics <sup>c</sup>	250	9.8E-09	8.9E-08	5.0E-04	NA	NA	NA	NA	NA	NA	---
Diphenyl ether	148	5.8E-09	5.0E-07	1.7E-02	NA	NA	NA	NA	NA	NA	---
Ethylbenzene	0.67	2.6E-11	8.4E-10	1.1E-04	1.1E-02	1.1E-02	2.5E-06	2.9E-13	9.2E-12	2.8E-10	2.9E-10
Hydrazine	0.10	3.7E-12	9.5E-14	2.5E-07	3.0E+00	3.0E+00	4.9E-03	1.1E-11	2.9E-13	1.2E-09	1.2E-09
N-Nitrosodimethylamine	0.013	5.1E-13	7.7E-14	7.5E-08	5.1E+01	5.1E+01	1.4E-02	2.6E-11	3.9E-12	1.1E-09	1.1E-09
N-Nitrosodiphenylamine	77	3.0E-09	3.4E-08	NA	4.9E-03	4.9E-03	2.6E-06	1.5E-11	1.7E-10	NA	1.8E-10
Perchlorate	1.9	7.4E-11	4.7E-11	NA	NA	NA	NA	NA	NA	NA	---
Aluminum	895	3.5E-08	2.0E-08	NA	NA	NA	NA	NA	NA	NA	---
Antimony	2.3	9.0E-11	5.1E-11	NA	NA	NA	NA	NA	NA	NA	---
Arsenic	5.4	2.1E-10	1.2E-10	NA	1.5E+00	1.5E+00	4.3E-03	3.2E-10	1.8E-10	NA	5.0E-10
Chromium-Hexavalent	0.96	3.8E-11	4.2E-11	NA	5.0E-01	2.0E+01	8.4E-02	1.9E-11	8.5E-10	NA	8.7E-10
Cobalt	5.6	2.2E-10	5.0E-11	NA	NA	NA	9.0E-03	NA	NA	NA	---
Iron	6122	2.4E-07	1.4E-07	NA	NA	NA	NA	NA	NA	NA	---
Manganese	266	1.0E-08	5.9E-09	NA	NA	NA	NA	NA	NA	NA	---
Mercury	0.17	6.7E-12	3.8E-12	NA	NA	NA	NA	NA	NA	NA	---
Vanadium	157	6.2E-09	3.5E-09	NA	NA	NA	NA	NA	NA	NA	---
							<b>Total</b>	4.2E-10	3.0E-08	6.4E-09	3.7E-08

<sup>a</sup> See Table 1-2.

NA = Not available.

mg/kg = Milligram/kilogram.

µg/L = Microgram/liter.

µg/m³ = Microgram/cubic meter.

CSF = Cancer Slope Factor.

URF = Unit Risk Factor.

**Table 1-4**  
**Exposure Doses and Hazard Quotients for Future Utility Worker Exposure to Shallow Groundwater in Construction Trenches**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Contaminant of Potential Concern (COPC)	Exposure Point Concentration (EPC) <sup>a</sup> ( $\mu\text{g/L}$ )	Exposure Doses			Toxicity Values				Hazard Quotients			Hazard Index
		Ingestion ( $\text{mg/kg-day}$ )	Dermal Contact ( $\text{mg/kg-day}$ )	Inhalation (VOCs) ( $\text{mg/m}^3$ )	Oral RfD ( $\text{mg/kg-day}$ )	Dermal RfD ( $\text{mg/kg-day}$ )	Inhalation RfC ( $\text{mg/m}^3$ )	Primary Target Organ	Ingestion	Dermal Contact	Inhalation (VOCs)	
1,1'-Biphenyl	27	9.2E-07	6.5E-05	2.8E-03	5.0E-01	5.0E-01	4.0E-04	Urinary	0.0000018	0.00013	7.0	7.0
Benzene	2.5	8.6E-08	7.8E-07	4.3E-04	4.0E-03	4.0E-03	3.0E-02	Immune System	0.000021	0.00019	0.014	0.014
Bis(2-ethylhexyl)phthalate	26	8.8E-07	1.8E-03	NA	2.0E-02	2.0E-02	NA	Hepatic	0.000044	0.089	NA	0.089
C5-C8 Aliphatics <sup>b</sup>	418	1.4E-05	2.0E-03	6.9E-02	NA	NA	6.0E-01	None	NA	NA	0.11	0.11
C9-C10 Aromatics <sup>c</sup>	3	8.8E-08	8.0E-07	4.4E-04	4.0E-03	4.0E-03	3.0E-02	Immune System	0.000022	0.00020	0.015	0.015
C11-C22 Aromatics <sup>c</sup>	250	8.6E-06	7.8E-05	4.4E-04	4.0E-03	4.0E-03	3.0E-02	Immune System	0.0021	0.019	0.015	0.04
Diphenyl ether	148	5.1E-06	4.4E-04	1.4E-02	NA	NA	4.0E-04	None	NA	NA	36	36
Ethylbenzene	0.67	2.3E-08	7.3E-07	9.9E-05	1.0E-01	1.0E-01	1.0E+00	Hepatic, Urinary	0.00000023	0.0000073	0.00010	0.00011
Hydrazine	0.095	3.3E-09	8.3E-11	2.2E-07	NA	NA	3.0E-05	Hepatic	NA	NA	0.0072	0.0072
N-Nitrosodimethylamine	0.013	4.5E-10	6.7E-11	6.6E-08	8.0E-06	8.0E-06	4.0E-05	Developmental	0.000056	0.0000084	0.0016	0.0017
N-Nitrosodiphenylamine	77	2.6E-06	3.0E-05	NA	NA	NA	NA	Body Weight	NA	NA	NA	---
Perchlorate	1.9	6.5E-08	4.1E-08	NA	7.0E-04	7.0E-04	NA	Endocrine	0.000093	0.000059	NA	0.00015
Aluminum	895	3.1E-05	1.7E-05	NA	1.0E+00	1.0E+00	5.0E-03	Neurological	0.000031	0.000017	NA	0.000048
Antimony	2.3	7.9E-08	4.5E-08	NA	4.0E-04	6.0E-05	NA	Hematologic	0.000020	0.00074	NA	0.00094
Arsenic	5.4	1.9E-07	1.0E-07	NA	3.0E-04	3.0E-04	1.5E-05	Cardiovascular, Dermal	0.00062	0.00035	NA	0.00097
Chromium-Hexavalent	0.96	3.3E-08	3.7E-08	NA	3.0E-03	7.5E-05	1.0E-04	Gastrointestinal Tract, Respiratory	0.000011	0.00049	NA	0.00051
Cobalt	5.6	1.9E-07	4.4E-08	NA	3.0E-04	3.0E-04	6.0E-06	Respiratory	0.00064	0.00015	NA	0.00079
Iron	6122	2.1E-04	1.2E-04	NA	7.0E-01	7.0E-01	NA	Gastrointestinal Tract	0.000030	0.00017	NA	0.00047
Manganese	266	9.1E-06	5.1E-06	NA	1.4E-01	1.4E-01	5.0E-05	Nervous System	0.000065	0.000037	NA	0.00010
Mercury <sup>d</sup>	0.17	5.8E-09	3.3E-09	NA	3.0E-04	3.0E-04	3.0E-04	Immune, Urinary	0.000019	0.000011	NA	0.000030
Vanadium	157	5.4E-06	3.0E-06	NA	5.0E-03	1.3E-04	1.0E-04	Dermal	0.0011	0.023	NA	0.024
								Total	0.0053	0.13	43	44

<sup>a</sup> See Table 1-2.

<sup>b</sup> Total Petroleum Hydrocarbons (Aliphatic Low) toxicity values used for C5-C8 Aliphates.

<sup>c</sup> Total Petroleum Hydrocarbons (Aromatic Low) toxicity values used for C9-C10 Aromatics and C11-C22 Aromatics.

<sup>d</sup> Mercuric chloride toxicity values used for mercury.

NA = Not available.

$\mu\text{g}/\text{m}^3$  = Microgram/cubic meter.

$\text{mg}/\text{m}^3$  = Milligram/cubic meter.

RfC = Reference Concentration.

RfD = Reference Dose.

**Table 1-5**  
**Exposure Doses and Cancer Risks for Future Adolescent Trespassers to Surface Water**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Contaminant of Potential Concern (COPC)	Exposure Point Concentration (EPC) <sup>a</sup> (µg/L)	Exposure Doses		Toxicity Values		Cancer Risks		
		Ingestion <sup>b</sup> (mg/kg-day)	Dermal Contact (mg/kg-day)	Oral CSF (mg/kg-day) <sup>c</sup>	Dermal CSF (mg/kg-day) <sup>c</sup>	Ingestion	Dermal Contact	Total
1,1'-Biphenyl	27	6.2E-07	8.9E-06	8.0E-03	8.0E-03	5.0E-09	7.1E-08	7.6E-08
Benzene	2.5	5.8E-08	7.5E-08	5.5E-02	5.5E-02	3.2E-09	4.1E-09	7.3E-09
Bis(2-ethylhexyl)phthalate	26	6.0E-07	2.8E-04	1.4E-02	1.4E-02	8.4E-09	3.9E-06	3.9E-06
C5-C8 Aliphatics <sup>b</sup>	418	9.7E-06	2.4E-04	NA	NA	NA	NA	---
C9-C10 Aromatics <sup>c</sup>	2.6	6.0E-08	7.7E-08	NA	NA	NA	NA	---
C11-C22 Aromatics <sup>c</sup>	250	5.8E-06	7.5E-06	NA	NA	NA	NA	---
Diphenyl ether	148	3.4E-06	4.6E-05	NA	NA	NA	NA	---
Ethylbenzene	0.67	1.6E-08	8.0E-08	1.1E-02	1.1E-02	1.7E-10	8.8E-10	1.1E-09
Hydrazine	0.10	2.2E-09	7.3E-12	3.0E+00	3.0E+00	6.6E-09	2.2E-11	6.6E-09
N-Nitrosodimethylamine	0.013	3.0E-10	6.3E-12	5.1E+01	5.1E+01	1.5E-08	3.2E-10	1.6E-08
N-Nitrosodiphenylamine	77	1.8E-06	3.9E-06	4.9E-03	4.9E-03	8.8E-09	1.9E-08	2.8E-08
Perchlorate	1.9	4.4E-08	4.3E-09	NA	NA	NA	NA	---
Aluminum	895	2.1E-05	1.4E-06	NA	NA	NA	NA	---
Antimony	2.3	5.3E-08	3.5E-09	NA	NA	NA	NA	---
Arsenic	5.4	1.3E-07	8.2E-09	1.5E+00	1.5E+00	1.9E-07	1.2E-08	2.0E-07
Chromium-Hexavalent	0.96	2.2E-08	2.9E-09	5.0E-01	2.0E+01	1.1E-08	5.8E-08	6.9E-08
Cobalt	5.6	1.3E-07	3.4E-09	NA	NA	NA	NA	---
Iron	6122	1.4E-04	9.3E-06	NA	NA	NA	NA	---
Manganese	266	6.1E-06	4.0E-07	NA	NA	NA	NA	---
Mercury	0.17	3.9E-09	2.6E-10	NA	NA	NA	NA	---
Vanadium	157	3.6E-06	2.4E-07	NA	NA	NA	NA	---
						2.5E-07	4.1E-06	4.3E-06

<sup>a</sup> See Table 1-2.

<sup>b</sup> Total Petroleum Hydrocarbons (Aliphatic Low) toxicity values used for C5-C8 Aliphatics.

<sup>c</sup> Total Petroleum Hydrocarbons (Aromatic Low) toxicity values used for C9-C10 Aromatics and C11-C22 Aromatics.

NA = Not available.

mg/kg = Milligram/kilogram.

µg/L = Microgram/liter.

µg/m<sup>3</sup> = Microgram/cubic meter.

CSF = Cancer Slope Factor.

URF = Unit Risk Factor.

**Table 1-6**  
**Exposure Doses and Hazard Quotients for Future Adolescent Trespassers to Surface Water**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Contaminant of Potential Concern (COPC)	Exposure Point Concentration (EPC) <sup>a</sup> ( $\mu\text{g/L}$ )	Exposure Doses		Toxicity Values			Hazard Quotients		Hazard Index
		Ingestion <sup>b</sup> ( $\text{mg/kg-day}$ )	Dermal Contact ( $\text{mg/kg-day}$ )	Oral RfD ( $\text{mg/kg-day}$ )	Dermal RfD ( $\text{mg/kg-day}$ )	Primary Target Organ	Ingestion	Dermal Contact	
1,1'-Biphenyl	27	4.4E-06	6.2E-05	5.0E-01	5.0E-01	Urinary	0.0000087	0.00012	0.00013
Benzene	2.5	4.0E-07	5.3E-07	4.0E-03	4.0E-03	Immune System	0.00010	0.00013	0.00023
Bis(2-ethylhexyl)phthalate	26	4.2E-06	2.0E-03	2.0E-02	2.0E-02	Hepatic	0.00021	0.098	0.098
C5-C8 Aliphatics <sup>b</sup>	418	6.8E-05	1.7E-03	NA	NA	None	NA	NA	---
C9-C10 Aromatics <sup>c</sup>	2.6	4.2E-07	5.4E-07	4.0E-03	4.0E-03	Immune System	0.00010	0.00014	0.00024
C11-C22 Aromatics <sup>c</sup>	250	4.0E-05	5.3E-05	4.0E-03	4.0E-03	Immune System	0.010	0.013	0.023
Diphenyl ether	148	2.4E-05	3.3E-04	NA	NA	None	NA	NA	---
Ethylbenzene	0.67	1.1E-07	5.6E-07	1.0E-01	1.0E-01	Hepatic, Urinary	0.0000011	0.0000056	0.0000067
Hydrazine	0.095	1.5E-08	5.1E-11	NA	NA	Hepatic	NA	NA	---
N-Nitrosodimethylamine	0.013	2.1E-09	4.4E-11	8.0E-06	8.0E-06	Developmental	0.00026	0.0000055	0.00027
N-Nitrosodiphenylamine	77	1.3E-05	2.7E-05	NA	NA	Body Weight	NA	NA	---
Perchlorate	1.9	3.1E-07	3.0E-08	7.0E-04	7.0E-04	Endocrine	0.00044	0.000043	0.00048
Aluminum	895	1.4E-04	9.5E-06	1.0E+00	1.0E+00	Neurological	0.00014	0.0000095	0.00015
Antimony	2.3	3.7E-07	2.5E-08	4.0E-04	6.0E-05	Hematologic	0.00094	0.00041	0.0013
Arsenic	5.4	8.8E-07	5.8E-08	3.0E-04	3.0E-04	Cardiovascular, Dermal	0.0029	0.00019	0.0031
Chromium-Hexavalent	0.96	1.6E-07	2.0E-08	3.0E-03	7.5E-05	Gastrointestinal Tract, Respiratory	0.000052	0.00027	0.00032
Cobalt	5.6	9.1E-07	2.4E-08	3.0E-04	3.0E-04	Respiratory	0.0030	0.000080	0.0031
Iron	6122	9.9E-04	6.5E-05	7.0E-01	7.0E-01	Gastrointestinal Tract	0.0014	0.000093	0.0015
Manganese	266	4.3E-05	2.8E-06	1.4E-01	1.4E-01	Nervous System	0.00031	0.000020	0.00033
Mercury <sup>d</sup>	0.17	2.8E-08	1.8E-09	3.0E-04	3.0E-04	Immune, Urinary	0.000092	0.0000060	0.000098
Vanadium	157	2.5E-05	1.7E-06	5.0E-03	1.3E-04	Dermal	0.0051	0.013	0.018
<b>Total</b>							0.025	0.13	0.15

<sup>a</sup> See Table 1-2.

<sup>b</sup> Total Petroleum Hydrocarbons (Aliphatic Low) toxicity values used for C5-C8 Aliphates.

<sup>c</sup> Total Petroleum Hydrocarbons (Aromatic Low) toxicity values used for C9-C10 Aromatics and C11-C22 Aromatics.

<sup>d</sup> Mercuric chloride toxicity values used for mercury.

NA = Not available

$\mu\text{g}/\text{m}^3$  = Microgram/cubic meter

$\text{mg}/\text{m}^3$  = Milligram/cubic meter

RfC = Reference Concentration

RfD = Reference Dose

**TABLE 1-7**  
**CALCULATION OF Cair FROM VAPOR IN CONSTRUCTION TRENCH MODEL**  
**OLIN CHEMICAL SUPERFUND SITE**  
**WILMINGTON, MASSACHUSETTS**

Groundwater COPC	CAS No.	Molecular Weight MW <sub>i</sub> (g/mol)	Henry's Law Constant H <sub>i</sub> (atm·m <sup>3</sup> /mol)	Gas-Phase Mass Transfer Coefficient K <sub>iG</sub> (cm/s)	Liquid-Phase Mass Transfer Coefficient K <sub>iL</sub> (cm/s)	Overall Mass Transfer Coefficient K <sub>i</sub> (cm/s)	Concentration of Contaminant in Groundwater C <sub>gw</sub> (ug/L)	Volatilization Factor VF (L/m <sup>3</sup> )	Concentration of Contaminant in Trench Air Cair (ug/m <sup>3</sup> )	Concentration of Contaminant in Trench Air Cair (mg/m <sup>3</sup> )
<b>Volatile Organic Compounds (VOCs)</b>										
1,1'-Biphenyl	92524	154	3.08E-04	4.06E-01	9.11E-04	7.73E-04	2.70E+01	5.71E+00	1.54E+02	1.54E-01
Benzene	71432	78	5.55E-03	5.09E-01	1.28E-03	1.27E-03	2.50E+00	9.35E+00	2.34E+01	2.34E-02
C5-C8 Aliphatics	E1790666	86	1.80E+00	4.93E-01	1.22E-03	1.22E-03	4.18E+02	9.00E+00	3.76E+03	3.76E+00
C9-C10 Aromatics	E1790672	78	5.55E-03	5.09E-01	1.28E-03	1.27E-03	2.58E+00	9.35E+00	2.41E+01	2.41E-02
C11-C22 Aromatics	E1790672	78	5.55E-03	5.09E-01	1.28E-03	1.27E-03	2.50E+02	9.35E+00	2.34E+03	2.34E+00
Diphenyl ether	101848	170	2.79E-04	3.92E-01	8.67E-04	7.27E-04	1.48E+02	5.36E+00	7.92E+02	7.92E-01
Ethylbenzene	100414	106	7.88E-03	4.60E-01	1.10E-03	1.09E-03	6.72E-01	8.05E+00	5.41E+00	5.41E-03
Hydrazine	302012	32	6.07E-07	6.87E-01	2.00E-03	1.69E-05	9.50E-02	1.25E-01	1.19E-02	1.19E-05
N-Nitrosodimethylamine	62759	74	1.82E-06	5.19E-01	1.31E-03	3.75E-05	1.30E-02	2.77E-01	3.60E-03	3.60E-06

Source: Model obtained from Virginia Department of Environmental Quality (VDEQ), 2013 Voluntary Remediation Program (VRP) for groundwater less than 15 feet.

**TABLE 1-8**  
**DERMALLY ABSORBED DOSE PER EVENT (DA<sub>event</sub>) CALCULATIONS<sup>a</sup> - UTILITY WORKER - RME - SHALLOW GROUNDWATER**  
**OLIN CHEMICAL SUPERFUND SITE**  
**WILMINGTON, MASSACHUSETTS**

COPC	EPC <sup>b</sup>		FA (unitless)	K <sub>p</sub> (cm/hr)	T <sub>event</sub> (hr/event)	B (unitless)	t <sup>c</sup> (hr)	D <sub>aevent</sub> <sup>c,d</sup> (mg/cm <sup>2</sup> -event)
	( $\mu$ g/L)	(mg/cm <sup>3</sup> )						
1,1'-Biphenyl	2.70E+01	2.70E-05	1.0	9.43E-02	7.68E-01	4.50E-01	1.84E+00	2.7E-05
Benzene	2.50E+00	2.50E-06	1.0	1.49E-02	2.88E-01	5.07E-02	6.91E-01	3.2E-07
Bis(2-ethylhexyl)phthalate	2.58E+01	2.58E-05	0.8	1.13E+00	1.62E+01	8.59E+00	7.29E+01	7.3E-04
C5-C8 Aliphatics	4.18E+02	4.18E-04	1.0	2.01E-01	3.19E-01	7.18E-01	1.24E+00	8.2E-04
C9-C10 Aromatics	2.58E+00	2.58E-06	1.0	1.49E-02	2.88E-01	5.07E-02	6.91E-01	3.3E-07
C11-C22 Aromatics	2.50E+02	2.50E-04	1.0	1.49E-02	2.88E-01	5.07E-02	6.91E-01	3.2E-05
Diphenyl ether	1.48E+02	1.48E-04	1.0	1.09E-01	9.44E-01	5.47E-01	2.27E+00	1.8E-04
Ethylbenzene	6.72E-01	6.72E-07	1.0	4.93E-02	4.13E-01	1.95E-01	9.92E-01	3.0E-07
Hydrazine	9.50E-02	9.50E-08	1.0	4.36E-05	1.59E-01	9.50E-05	3.82E-01	3.4E-11
N-Nitrosodimethylamine	1.30E-02	1.30E-08	1.0	2.51E-04	2.73E-01	8.31E-04	6.56E-01	2.8E-11
N-Nitrosodiphenylamine	7.72E+01	7.72E-05	1.0	1.45E-02	1.35E+00	7.85E-02	3.25E+00	1.2E-05
Perchlorate	1.90E+00	1.90E-06	1.0	1.00E-03	4.78E-01	4.17E-03	1.15E+00	1.7E-08
Aluminum	8.95E+02	8.95E-04	1.0	1.00E-03	1.49E-01	2.00E-03	3.57E-01	7.2E-06
Antimony	2.31E+00	2.31E-06	1.0	1.00E-03	5.05E-01	4.24E-03	1.21E+00	1.8E-08
Arsenic	5.42E+00	5.42E-06	1.0	1.00E-03	2.76E-01	3.33E-03	6.63E-01	4.3E-08
Chromium-Hexavalent	9.60E-01	9.60E-07	1.0	2.00E-03	2.06E-01	5.55E-03	4.93E-01	1.5E-08
Cobalt	5.63E+00	5.63E-06	1.0	4.00E-04	2.25E-01	1.18E-03	5.40E-01	1.8E-08
Iron	6.12E+03	6.12E-03	1.0	1.00E-03	2.16E-01	2.87E-03	5.19E-01	4.9E-05
Manganese	2.66E+02	2.66E-04	1.0	1.00E-03	2.14E-01	2.85E-03	5.13E-01	2.1E-06
Mercury	1.70E-01	1.70E-07	1.0	1.00E-03	1.40E+00	5.45E-03	3.35E+00	1.4E-09
Vanadium	1.57E+02	1.57E-04	1.0	1.00E-03	2.03E-01	2.75E-03	4.87E-01	1.3E-06

<sup>a</sup> EPA, 2004.

<sup>b</sup> See Table 1-2

<sup>c</sup> t<sub>event</sub> was assumed to be 8 based on professional judgement.

<sup>d</sup> Calculated based on Equation 3.2 or 3.3 for organics in EPA, 2004 where t<sub>event</sub> equals 8.

B = Ratio of the permeability coefficient of a COPC through the stratum corneum relative to its permeability coefficient across the viable epidermis.

FA = Fraction absorbed.

K<sub>p</sub> = Dermal permeability coefficient.

NA = Not applicable.

T<sub>event</sub> = Lag time per event.

t<sup>\*</sup> = Time to reach steady-state.

EPC = Exposure Point Concentration

**TABLE 1-9**  
**DERMALLY ABSORBED DOSE PER EVENT (DA<sub>event</sub>) CALCULATIONS<sup>a</sup> - ADOLESCENT TRESPASSER - RME - SURFACE WATER**  
**OLIN CHEMICAL SUPERFUND SITE**  
**WILMINGTON, MASSACHUSETTS**

COPC	EPC <sup>b</sup>		FA (unitless)	K <sub>p</sub> (cm/hr)	T <sub>event</sub> (hr/event)	B (unitless)	t (hr)	DA <sub>event</sub> (mg/cm <sup>2</sup> - event) <sup>c,d</sup>
	( $\mu$ g/L)	(mg/cm <sup>3</sup> )						
1,1'-Biphenyl	2.70E+01	2.70E-05	1.0	9.43E-02	7.68E-01	4.50E-01	1.84E+00	1.2E-05
Benzene	2.50E+00	2.50E-06	1.0	1.49E-02	2.88E-01	5.07E-02	6.91E-01	9.9E-08
Bis(2-ethylhexyl)phthalate	2.58E+01	2.58E-05	0.8	1.13E+00	1.62E+01	8.59E+00	7.29E+01	3.7E-04
C5-C8 Aliphatics	4.18E+02	4.18E-04	1.0	2.01E-01	3.19E-01	7.18E-01	1.24E+00	3.1E-04
C9-C10 Aromatics	2.58E+00	2.58E-06	1.0	1.49E-02	2.88E-01	5.07E-02	6.91E-01	1.0E-07
C11-C22 Aromatics	2.50E+02	2.50E-04	1.0	1.49E-02	2.88E-01	5.07E-02	6.91E-01	9.9E-06
Diphenyl ether	1.48E+02	1.48E-04	1.0	1.09E-01	9.44E-01	5.47E-01	2.27E+00	6.1E-05
Ethylbenzene	6.72E-01	6.72E-07	1.0	4.93E-02	4.13E-01	1.95E-01	9.92E-01	1.1E-07
Hydrazine	9.50E-02	9.50E-08	1.0	4.36E-05	1.59E-01	9.50E-05	3.82E-01	9.6E-12
N-Nitrosodimethylamine	1.30E-02	1.30E-08	1.0	2.51E-04	2.73E-01	8.31E-04	6.56E-01	8.3E-12
N-Nitrosodiphenylamine	7.72E+01	7.72E-05	1.0	1.45E-02	1.35E+00	7.85E-02	3.25E+00	5.1E-06
Perchlorate	1.90E+00	1.90E-06	1.0	1.00E-03	4.78E-01	4.17E-03	1.15E+00	5.6E-09
Aluminum	8.95E+02	8.95E-04	1.0	1.00E-03	1.49E-01	2.00E-03	3.57E-01	1.8E-06
Antimony	2.31E+00	2.31E-06	1.0	1.00E-03	5.05E-01	4.24E-03	1.21E+00	4.6E-09
Arsenic	5.42E+00	5.42E-06	1.0	1.00E-03	2.76E-01	3.33E-03	6.63E-01	1.1E-08
Chromium-Hexavalent	9.60E-01	9.60E-07	1.0	2.00E-03	2.06E-01	5.55E-03	4.93E-01	3.8E-09
Cobalt	5.63E+00	5.63E-06	1.0	4.00E-04	2.25E-01	1.18E-03	5.40E-01	4.5E-09
Iron	6.12E+03	6.12E-03	1.0	1.00E-03	2.16E-01	2.87E-03	5.19E-01	1.2E-05
Manganese	2.66E+02	2.66E-04	1.0	1.00E-03	2.14E-01	2.85E-03	5.13E-01	5.3E-07
Mercury	1.70E-01	1.70E-07	1.0	1.00E-03	1.40E+00	5.45E-03	3.35E+00	3.4E-10
Vanadium	1.57E+02	1.57E-04	1.0	1.00E-03	2.03E-01	2.75E-03	4.87E-01	3.1E-07

<sup>a</sup> EPA, 2004.

<sup>b</sup> See Table 1-2

<sup>c</sup> t<sub>event</sub> was assumed to be 2 based on professional judgement.

<sup>d</sup> Calculated based on Equation 3.2 or 3.3 for organics in EPA, 2004 where t<sub>event</sub> is assumed 2.

B = Ratio of the permeability coefficient of a COPC through the stratum corneum relative to its permeability coefficient across the viable epidermis.

FA = Fraction absorbed.

K<sub>p</sub> = Dermal permeability coefficient.

NA = Not applicable.

t<sub>event</sub> = Lag time per event.

t' = Time to reach steady-state.

EPC = Exposure Point Concentration

**Table 1-10**  
**Groundwater Samples Used in Risk Assessment**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Sample Location	Sample ID	Date Collected
B-03	OC-B-03-XXX-20100510	5/10/2010
B-03	OC-B-03-XXX-20101011	10/11/2010
B-03	OC-B-03-20101118	11/18/2010
B-03	OC-B-03-20111109	11/9/2011
B-03	OC-B-03-20121114	11/14/2012
B-03	OC-B-03-20131119	11/19/2013
B-03	OC-B-03-20131120	11/20/2013
B-03	OC-B-03-20141105	11/5/2014
B-03	OC-B-03-20151105	11/5/2015
B-03	OC-DUP-3 GW-20151105	11/5/2015
B-03	OC-B-03-20161206	12/6/2016
B-07-A	OC-B-07-A-XXX-20100512	5/12/2010
B-07-A	OC-B-07-A-XXX-20101011	10/11/2010
GW-13	OC-GW-13-XXX-20100510	5/10/2010
GW-13	OC-GW-13-XXX-20101012	10/12/2010
GW-13	OC-GW-13-20101118	11/18/2010
GW-13	OC-GW-13-20111110	11/10/2011
GW-13	OC-GW-13-20121114	11/14/2012
GW-13	OC-GW-13-20131120	11/20/2013
GW-13	OC-GW-13-20141105	11/5/2014
GW-13	OG-GW-13-20151105	11/5/2015
GW-13	OC-GW-13-20161206	12/6/2016
GW-14	OC-GW-14-XXX-20100513	5/13/2010
GW-14	OC-GW-14-XXX-20101013	10/13/2010
GW-15	OC-GW-15-DUP	5/13/2010
GW-15	OC-GW-15-XXX-20100513	5/13/2010
GW-15	OC-GW-15-XXX-20101012	10/12/2010
GW-16	OC-GW-16R-20130510	5/10/2013
GW-52S	OC-GW-52S-XXX-20100513	5/13/2010
GW-52S	OC-GW-52S-XXX-20101013	10/13/2010
GW-101	OC-GW-101-XXX-20100512	5/12/2010
GW-101	OC-GW-101-XXX-20101011	10/11/2010
GW-101	OC-GW-101-20101118	11/18/2010
GW-101	OC-GW-101-20111109	11/9/2011
GW-101	OC-GW-101-20121115	11/15/2012
GW-101	OC-GW-101-20131120	11/20/2013
GW-101	OC-GW-101-20141105	11/5/2014
GW-101	OC-GW-101-20151105	11/5/2015
GW-101	OC-GW-101-20161206	12/6/2016
IW-6	OC-IW-6-20101118	11/18/2010
IW-6	OC-IW-6-20111109	11/9/2011
IW-6	OC-IW-6-20121114	11/14/2012
IW-6	OC-IW-6-20131120	11/20/2013
IW-6	OC-IW-6-20141105	11/5/2014
IW-6	OC-IW-6-20151105	11/5/2015
IW-6	OC-IW-6-20161206	12/6/2016
IW-10	OC-IW-10-20101118	11/18/2010
IW-10	OC-IW-10-20111109	11/9/2011
IW-10	OC-IW-10-20121114	11/14/2012
IW-10	OC-IW-10-20131119	11/19/2013
IW-10	OC-IW-10-20131120	11/20/2013
IW-10	OC-IW-10-20141105	11/5/2014
IW-10	OC-IW-10-20151106	11/6/2015
IW-10	OC-IW-10-20161206	12/6/2016
IW-11	IW-11-20130906	9/6/2013
IW-12	IW-12-20130906	9/6/2013
IW-13	IW-13-20130906	9/6/2013

**Table 2-1**  
**Comparison to Ecological Benchmarks for Ammonia**  
**Olin Chemical Superfund Site**  
**Page 1 of 7**

Location	Analyte	Sample ID	Sample Type	Date	Result mg/L	Chronic Benchmark Values (mg/L)	
						30°C, pH 7	20°C, pH 7
B-03	Nitrogen, As Ammonia	B-03-19921110	N	11/10/1992	18	0.99	1.9
	Nitrogen, As Ammonia	B-3/GW-14	N	12/2/1997	7.26	0.99	1.9
	Nitrogen, As Ammonia	B-3-19980213	N	2/13/1998	1.2	0.99	1.9
	Nitrogen, As Ammonia	B-3-19980514	N	5/14/1998	0.5	0.99	1.9
	Nitrogen, As Ammonia	B-3-19980811	N	8/11/1998	1.14	0.99	1.9
	Nitrogen, As Ammonia	B-3-19981021	N	10/21/1998	4.6	0.99	1.9
	Nitrogen, As Ammonia	B-3-19981021	FD	10/21/1998	8.1	0.99	1.9
	Nitrogen, As Ammonia	B-3-19990218	N	2/18/1999	8.9	0.99	1.9
	Nitrogen, As Ammonia	B-3-19990218	FD	2/18/1999	7.6	0.99	1.9
	Nitrogen, As Ammonia	B-03-19990526	N	5/26/1999	11	0.99	1.9
	Nitrogen, As Ammonia	B-3-19990806	N	8/6/1999	24	0.99	1.9
	Nitrogen, As Ammonia	B-3-20000810	N	8/10/2000	10	0.99	1.9
	Nitrogen, As Ammonia	B-3-20010815	N	8/15/2001	7	0.99	1.9
	Nitrogen, As Ammonia	B-3-20020815	N	8/15/2002	4.91	0.99	1.9
	Nitrogen, As Ammonia	B-3-20030820	N	8/20/2003	0.29	0.99	1.9
	Nitrogen, As Ammonia	B-3-20040819	N	8/19/2004	2.7	0.99	1.9
	Nitrogen, As Ammonia	B-3-20050803	N	8/3/2005	0.76	0.99	1.9
	Nitrogen, As Ammonia	OC-B-03-20071115	N	11/15/2007	1.5	0.99	1.9
	Nitrogen, As Ammonia	OC-B-03-20081124	N	11/24/2008	0.64	0.99	1.9
	Nitrogen, As Ammonia	OC-B-03-20091112	N	11/12/2009	1	0.99	1.9
	Nitrogen, As Ammonia	OC-B-03-XXX-20100510	N	5/10/2010	0.17	0.99	1.9
	Nitrogen, As Ammonia	OC-B-03-XXX-20101011	N	10/11/2010	0.12	0.99	1.9
	Nitrogen, As Ammonia	OC-B-03-20101118	N	11/18/2010	0.21	0.99	1.9
	Nitrogen, As Ammonia	OC-B-03-20111109	N	11/9/2011	0.34	0.99	1.9
	Nitrogen, As Ammonia	OC-B-03-20121114	N	11/14/2012	0.02	0.99	1.9
	Nitrogen, As Ammonia	OC-B-03-20131119	N	11/19/2013	0.02	0.99	1.9
B-07-A	Ammonia	OC-B-03-20141105	N	11/5/2014	0.57	0.99	1.9
	Ammonia	OC-B-03-20151105	N	11/5/2015	0.34	0.99	1.9
GW-101	Ammonia	OC-B-03-20151105	FD	11/5/2015	0.2	0.99	1.9
	Ammonia	OC-B-03-20161206	N	12/6/2016	0.4	0.99	1.9
B-07-A	Nitrogen, As Ammonia	OC-B-07-A-XXX-20100512	N	5/12/2010	0.18	0.99	1.9
	Nitrogen, As Ammonia	OC-B-07-A-XXX-20101011	N	10/11/2010	0.77	0.99	1.9
GW-101	Nitrogen, As Ammonia	GW-101-19971202	FD	12/2/1997	0.5	0.99	1.9
	Nitrogen, As Ammonia	GW-101-19971202	N	12/2/1997	0.64	0.99	1.9
	Nitrogen, As Ammonia	GW-101-19980213	N	2/13/1998	0.5	0.99	1.9
	Nitrogen, As Ammonia	GW-101-19980514	N	5/14/1998	0.98	0.99	1.9
	Nitrogen, As Ammonia	GW-101-19980811	N	8/11/1998	0.5	0.99	1.9
	Nitrogen, As Ammonia	GW-101-19981021	N	10/21/1998	0.45	0.99	1.9
	Nitrogen, As Ammonia	GW-101-19990218	N	2/18/1999	0.58	0.99	1.9
	Nitrogen, As Ammonia	GW-101-19990526	N	5/26/1999	0.57	0.99	1.9
	Nitrogen, As Ammonia	GW-101-19990806	FD	8/6/1999	0.5	0.99	1.9
	Nitrogen, As Ammonia	GW-101-19990806	N	8/6/1999	0.57	0.99	1.9
	Nitrogen, As Ammonia	GW-101-20000810	FD	8/10/2000	0.53	0.99	1.9
	Nitrogen, As Ammonia	GW-101-20000810	N	8/10/2000	0.55	0.99	1.9
	Nitrogen, As Ammonia	GW-101-20010523	N	5/23/2001	0.5	0.99	1.9
	Nitrogen, As Ammonia	GW-101-20010816	N	8/16/2001	0.4	0.99	1.9

**Table 2-1**  
**Comparison to Ecological Benchmarks for Ammonia**  
**Olin Chemical Superfund Site**  
**Page 2 of 7**

Location	Analyte	Sample ID	Sample Type	Date	Result mg/L	Chronic Benchmark Values (mg/L)	
						30°C, pH 7	20°C, pH 7
GW-101 (cont.)	Nitrogen, As Ammonia	GW-101-20020815	N	8/15/2002	0.52	0.99	1.9
	Nitrogen, As Ammonia	GW-101-20030821	N	8/21/2003	0.78	0.99	1.9
	Nitrogen, As Ammonia	GW 101	FD	9/30/2003	0.19	0.99	1.9
	Nitrogen, As Ammonia	GW 101	N	9/30/2003	0.1	0.99	1.9
	Nitrogen, As Ammonia	GW-101-20040824	N	8/24/2004	0.52	0.99	1.9
	Nitrogen, As Ammonia	GW-101-20050803	N	8/3/2005	0.48	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-101-20071115	N	11/15/2007	0.92	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-101-20081124	N	11/24/2008	1.3	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-101-20091113	N	11/13/2009	0.63	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-101-XXX-2010051	N	5/12/2010	1.9	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-101-XXX-2010101	N	10/11/2010	1.7	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-101-20101118	N	11/18/2010	0.95	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-101-20111109	N	11/9/2011	1.2	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-101-20121115	N	11/15/2012	6	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-101-20131120	N	11/20/2013	4.8	0.99	1.9
	Ammonia	OC-GW-101-20141105	N	11/5/2014	1.9	0.99	1.9
	Ammonia	OC-GW-101-20151105	N	11/5/2015	1.4	0.99	1.9
	Ammonia	OC-GW-101-20161206	N	12/6/2016	1.9	0.99	1.9
GW-13	Nitrogen, As Ammonia	GW-13-19810301	N	3/1/1981	130	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19810401	N	4/1/1981	26	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19810501	N	5/1/1981	11	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19810601	N	6/1/1981	7	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19810801	N	8/1/1981	5	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19821001	N	10/1/1982	19.6	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19830601	N	6/1/1983	4.5	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19831001	N	10/1/1983	0.3	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19840701	N	7/1/1984	0.5	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19841201	N	12/1/1984	0.31	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19860626	N	6/26/1986	1	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19861201	N	12/1/1986	1	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19870601	N	6/1/1987	1	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19871201	N	12/1/1987	0.1	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19880519	N	5/19/1988	3.9	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19900501	N	5/1/1990	0.1	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19970724	N	7/24/1997	0.068	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19970930	N	9/30/1997	0.82	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19971202	N	12/2/1997	0.5	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19980212	FD	2/12/1998	0.5	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19980212	N	2/12/1998	0.5	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19980514	N	5/14/1998	0.5	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19980811	N	8/11/1998	0.5	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19981020	N	10/20/1998	0.1	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19990218	N	2/18/1999	0.01	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19990526	FD	5/26/1999	0.1	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19990526	N	5/26/1999	0.11	0.99	1.9
	Nitrogen, As Ammonia	GW-13-19990806	N	8/6/1999	0.1	0.99	1.9

**Table 2-1**  
**Comparison to Ecological Benchmarks for Ammonia**  
**Olin Chemical Superfund Site**  
**Page 3 of 7**

Location	Analyte	Sample ID	Sample Type	Date	Result mg/L	Chronic Benchmark Values (mg/L)	
						30°C, pH 7	20°C, pH 7
GW-13 (cont.)	Nitrogen, As Ammonia	GW-13-20000810	N	8/10/2000	0.13	0.99	1.9
	Nitrogen, As Ammonia	GW-13-20010523	N	5/23/2001	0.44	0.99	1.9
	Nitrogen, As Ammonia	GW-13-20020815	N	8/15/2002	0.1	0.99	1.9
	Nitrogen, As Ammonia	GW-13-20030821	N	8/21/2003	0.15	0.99	1.9
	Nitrogen, As Ammonia	GW-13-20040816	N	8/16/2004	0.25	0.99	1.9
	Nitrogen, As Ammonia	GW-13-20050803	N	8/3/2005	0.1	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-13-20071115	N	11/15/2007	0.1	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-13-20081124	N	11/24/2008	0.1	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-13-20091112	N	11/12/2009	0.1	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-13-XXX-20100510	N	5/10/2010	0.2	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-13-XXX-20101012	N	10/12/2010	0.33	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-13-20101118	N	11/18/2010	0.1	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-13-20111110	N	11/10/2011	0.19	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-13-20121114	N	11/14/2012	0.02	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-13-20131120	N	11/20/2013	0.02	0.99	1.9
GW-14	Ammonia	OC-GW-13-20141105	N	11/5/2014	0.2	0.99	1.9
	Ammonia	OG-GW-13-20151105	N	11/5/2015	0.11	0.99	1.9
	Ammonia	OC-GW-13-20161206	N	12/6/2016	0.11	0.99	1.9
	Nitrogen, As Ammonia	GW-14-19810301	N	3/1/1981	4	0.99	1.9
	Nitrogen, As Ammonia	GW-14-19810401	N	4/1/1981	10	0.99	1.9
	Nitrogen, As Ammonia	GW-14-19810501	N	5/1/1981	3	0.99	1.9
	Nitrogen, As Ammonia	GW-14-19810601	N	6/1/1981	7	0.99	1.9
	Nitrogen, As Ammonia	GW-14-19810801	N	8/1/1981	5	0.99	1.9
	Nitrogen, As Ammonia	GW-14-19860626	N	6/26/1986	10	0.99	1.9
	Nitrogen, As Ammonia	GW-14-19861201	N	12/1/1986	25	0.99	1.9
	Nitrogen, As Ammonia	GW-14-19870601	N	6/1/1987	70	0.99	1.9
	Nitrogen, As Ammonia	GW-14-19871201	N	12/1/1987	72	0.99	1.9
	Nitrogen, As Ammonia	GW-14-19880519	N	5/19/1988	0.27	0.99	1.9
	Nitrogen, As Ammonia	GW-14-19900501	N	5/1/1990	0.53	0.99	1.9
	Nitrogen, As Ammonia	GW-14-19970724	N	7/24/1997	24.7	0.99	1.9
	Nitrogen, As Ammonia	GW-14-19971001	N	10/1/1997	96.9	0.99	1.9
GW-15	Nitrogen, As Ammonia	OC-GW-14-XXX-20100513	N	5/13/2010	0.24	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-14-XXX-20101013	N	10/13/2010	13	0.99	1.9
	Nitrogen, As Ammonia	GW-15-19810301	N	3/1/1981	167	0.99	1.9
	Nitrogen, As Ammonia	GW-15-19810401	N	4/1/1981	182	0.99	1.9
	Nitrogen, As Ammonia	GW-15-19810501	N	5/1/1981	135	0.99	1.9
	Nitrogen, As Ammonia	GW-15-19810601	N	6/1/1981	333	0.99	1.9
	Nitrogen, As Ammonia	GW-15-19810801	N	8/1/1981	350	0.99	1.9
	Nitrogen, As Ammonia	GW-15-19821001	N	10/1/1982	518	0.99	1.9
	Nitrogen, As Ammonia	GW-15-19830601	N	6/1/1983	760	0.99	1.9
	Nitrogen, As Ammonia	GW-15-19831001	N	10/1/1983	560	0.99	1.9
	Nitrogen, As Ammonia	GW-15-19840701	N	7/1/1984	700	0.99	1.9
	Nitrogen, As Ammonia	GW-15-19841201	N	12/1/1984	600	0.99	1.9
	Nitrogen, As Ammonia	GW-15-19870601	N	6/1/1987	2500	0.99	1.9
	Nitrogen, As Ammonia	GW-15-19871201	N	12/1/1987	640	0.99	1.9
	Nitrogen, As Ammonia	GW-15-19880519	N	5/19/1988	260	0.99	1.9

**Table 2-1**  
**Comparison to Ecological Benchmarks for Ammonia**  
**Olin Chemical Superfund Site**  
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Location	Analyte	Sample ID	Sample Type	Date	Result mg/L	Chronic Benchmark Values (mg/L)	
						30°C, pH 7	20°C, pH 7
GW-15 (cont.)	Nitrogen, As Ammonia	GW-15-19900501	N	5/1/1990	630	0.99	1.9
	Nitrogen, As Ammonia	GW-15-20000118	N	1/18/2000	300	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-15-XXX-20100513	N	5/13/2010	26	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-15-XXX-20101012	N	10/12/2010	69	0.99	1.9
GW-16	Nitrogen, As Ammonia	GW-16-19810301	N	3/1/1981	13	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19810401	N	4/1/1981	22	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19810501	N	5/1/1981	4	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19810601	N	6/1/1981	2	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19810801	N	8/1/1981	4	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19861201	N	12/1/1986	7.4	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19871201	N	12/1/1987	5	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19880519	N	5/19/1988	6.7	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19900501	N	5/1/1990	1.7	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19970724	N	7/24/1997	1.66	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19971001	N	10/1/1997	2.66	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19971202	N	12/2/1997	1.64	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19980213	N	2/13/1998	0.5	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19980514	FD	5/14/1998	0.92	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19980514	N	5/14/1998	1.34	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19980811	N	8/11/1998	1.3	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19981020	N	10/20/1998	2.4	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19990218	N	2/18/1999	3.5	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19990526	N	5/26/1999	4.6	0.99	1.9
	Nitrogen, As Ammonia	GW-16-19990806	N	8/6/1999	8.6	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20000810	N	8/10/2000	2.5	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20010815	FD	8/15/2001	5.7	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20010815	N	8/15/2001	6.2	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20020815	FD	8/15/2002	1.97	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20020815	N	8/15/2002	1.48	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20030820	FD	8/20/2003	0.31	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20030820	N	8/20/2003	0.44	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20040315	N	3/15/2004	0.53	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20040816	FD	8/16/2004	1.2	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20040816	N	8/16/2004	1.3	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20050520	FD	5/20/2005	0.5	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20050520	N	5/20/2005	0.49	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20050804	FD	8/4/2005	0.77	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20050804	N	8/4/2005	0.65	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20051115	FD	11/15/2005	1.2	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20051115	N	11/15/2005	1.2	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20060222	FD	2/22/2006	0.6	0.99	1.9
	Nitrogen, As Ammonia	GW-16-20060222	N	2/22/2006	0.64	0.99	1.9
	Nitrogen, As Ammonia	GW16	N	8/21/2007	5.9	0.99	1.9
	Nitrogen, As Ammonia	GW16	FD	8/21/2007	5.9	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-16-20071115	FD	11/15/2007	6.9	0.99	1.9

**Table 2-1**  
**Comparison to Ecological Benchmarks for Ammonia**  
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Location	Analyte	Sample ID	Sample Type	Date	Result mg/L	Chronic Benchmark Values (mg/L)	
						30°C, pH 7	20°C, pH 7
GW-16 (cont.)	Nitrogen, As Ammonia	OC-GW-16-20071115	N	11/15/2007	6.9	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-16R-20130510	N	5/10/2013	4.8	0.99	1.9
GW-23	Nitrogen, As Ammonia	GW-23-19810801	N	8/1/1981	8	0.99	1.9
	Nitrogen, As Ammonia	GW-23-19871201	N	12/1/1987	57	0.99	1.9
GW-52S	Nitrogen, As Ammonia	GW-52-S-19910801	N	8/1/1991	65	0.99	1.9
	Nitrogen, As Ammonia	GW-52-S-19920804	N	8/4/1992	49	0.99	1.9
	Nitrogen, As Ammonia	GW-52-S-19921103	N	11/3/1992	46	0.99	1.9
	Nitrogen, As Ammonia	GW-52S-20000118	N	1/18/2000	13	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-52S-XXX-2010051	N	5/13/2010	1.3	0.99	1.9
	Nitrogen, As Ammonia	OC-GW-52S-XXX-2010101	N	10/13/2010	2.9	0.99	1.9
IW-1	Nitrogen, As Ammonia	IWI	N	9/29/2003	2.01	0.99	1.9
IW-10	Nitrogen, As Ammonia	IW-10-19970724	N	7/24/1997	62.4	0.99	1.9
	Nitrogen, As Ammonia	IW-10-19970930	FD	9/30/1997	29.6	0.99	1.9
	Nitrogen, As Ammonia	IW-10-19970930	N	9/30/1997	31.2	0.99	1.9
	Nitrogen, As Ammonia	IW-10-19971202	N	12/2/1997	20.4	0.99	1.9
	Nitrogen, As Ammonia	IW-10-19980514	N	5/14/1998	58.2	0.99	1.9
	Nitrogen, As Ammonia	IW-10-19980811	FD	8/11/1998	17.9	0.99	1.9
	Nitrogen, As Ammonia	IW-10-19980811	N	8/11/1998	20.4	0.99	1.9
	Nitrogen, As Ammonia	IW-10-19990806	N	8/6/1999	0.39	0.99	1.9
	Nitrogen, As Ammonia	IW-10-20000810	N	8/10/2000	24	0.99	1.9
	Nitrogen, As Ammonia	IW-10-20010523	N	5/23/2001	32	0.99	1.9
	Nitrogen, As Ammonia	IW-10-20010815	N	8/15/2001	2.8	0.99	1.9
	Nitrogen, As Ammonia	IW-10-20020815	N	8/15/2002	1.5	0.99	1.9
	Nitrogen, As Ammonia	IW-10-20030821	N	8/21/2003	1.07	0.99	1.9
	Nitrogen, As Ammonia	IW-10-20040823	N	8/23/2004	2.5	0.99	1.9
	Nitrogen, As Ammonia	IW-10-20050803	N	8/3/2005	6.8	0.99	1.9
	Nitrogen, As Ammonia	OC-IW-10-20071115	N	11/15/2007	59	0.99	1.9
	Nitrogen, As Ammonia	OC-IW-10-20081124	N	11/24/2008	23	0.99	1.9
	Nitrogen, As Ammonia	OC-IW-10-20091113	N	11/13/2009	29	0.99	1.9
	Nitrogen, As Ammonia	OC-IW-10-20101118	N	11/18/2010	56	0.99	1.9
	Nitrogen, As Ammonia	OC-IW-10-20111109	N	11/9/2011	60	0.99	1.9
	Nitrogen, As Ammonia	OC-IW-10-20121114	N	11/14/2012	68	0.99	1.9
	Nitrogen, As Ammonia	OC-IW-10-20131119	N	11/19/2013	57	0.99	1.9
IW-11	Ammonia	OC-IW-10-20141105	N	11/5/2014	48	0.99	1.9
	Ammonia	OC-IW-10-20151106	N	11/6/2015	66	0.99	1.9
	Ammonia	OC-IW-10-20161206	N	12/6/2016	79	0.99	1.9
	Nitrogen, As Ammonia	IW-11-19880519	N	5/19/1988	4.7	0.99	1.9
	Nitrogen, As Ammonia	IW-11-19881208	N	12/8/1988	17	0.99	1.9
	Nitrogen, As Ammonia	IW-11-19890501	N	5/1/1989	12	0.99	1.9
	Nitrogen, As Ammonia	IW-11-19891101	N	11/1/1989	14	0.99	1.9
	Nitrogen, As Ammonia	IW-11-19900501	N	5/1/1990	12	0.99	1.9
	Nitrogen, As Ammonia	IW-11-19901121	N	11/21/1990	12	0.99	1.9
	Nitrogen, As Ammonia	IW-11-19901127	N	11/27/1990	8.4	0.99	1.9
	Nitrogen, As Ammonia	IW-11-19901128	N	11/28/1990	9.3	0.99	1.9
	Nitrogen, As Ammonia	IW-11-19911217	N	12/17/1991	100	0.99	1.9
	Nitrogen, As Ammonia	IW-11-19921110	N	11/10/1992	11	0.99	1.9

**Table 2-1**  
**Comparison to Ecological Benchmarks for Ammonia**  
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Location	Analyte	Sample ID	Sample Type	Date	Result mg/L	Chronic Benchmark Values (mg/L)	
						30°C, pH 7	20°C, pH 7
IW-11 (cont.)	Nitrogen, As Ammonia	IW-11-19970124	N	1/24/1997	4.99	0.99	1.9
	Nitrogen, As Ammonia	IW-11-20050316	N	3/16/2005	9.6	0.99	1.9
	Nitrogen, As Ammonia	IW-11-20050419	N	4/19/2005	15	0.99	1.9
	Nitrogen, As Ammonia	IW-11-20050518	N	5/18/2005	9.2	0.99	1.9
	Nitrogen, As Ammonia	IW-11-20050615	N	6/15/2005	9.8	0.99	1.9
	Nitrogen, As Ammonia	IW-11-20050817	N	8/17/2005	5.4	0.99	1.9
	Nitrogen, As Ammonia	IW-11-20050921	N	9/21/2005	4.7	0.99	1.9
	Nitrogen, As Ammonia	IW-11-20051019	N	10/19/2005	4.6	0.99	1.9
	Nitrogen, As Ammonia	IW-11-20051116	N	11/16/2005	5	0.99	1.9
	Nitrogen, As Ammonia	IW-11-20051221	N	12/21/2005	7.3	0.99	1.9
	Nitrogen, As Ammonia	IW-11-20060118	N	1/18/2006	10	0.99	1.9
	Nitrogen, As Ammonia	IW-11-20060217	N	2/17/2006	9.2	0.99	1.9
	Nitrogen, As Ammonia	IW-11-20060315	N	3/15/2006	6.2	0.99	1.9
	Nitrogen, As Ammonia	IW-11-20060420	N	4/20/2006	4.9	0.99	1.9
	Nitrogen, As Ammonia	IW-11-20060510	N	5/10/2006	4	0.99	1.9
IW-12	Nitrogen, As Ammonia	IW-12-19881208	N	12/8/1988	18	0.99	1.9
	Nitrogen, As Ammonia	IW-12-19890501	N	5/1/1989	11	0.99	1.9
	Nitrogen, As Ammonia	IW-12-19891101	N	11/1/1989	8.6	0.99	1.9
	Nitrogen, As Ammonia	IW-12-19900501	N	5/1/1990	5.6	0.99	1.9
	Nitrogen, As Ammonia	IW-12-19901121	N	11/21/1990	5.9	0.99	1.9
	Nitrogen, As Ammonia	IW-12-19901127	N	11/27/1990	5.8	0.99	1.9
	Nitrogen, As Ammonia	IW-12-19901128	N	11/28/1990	6.2	0.99	1.9
	Nitrogen, As Ammonia	IW-12-19970124	N	1/24/1997	3.8	0.99	1.9
	Nitrogen, As Ammonia	IW-12-20050316	N	3/16/2005	2.5	0.99	1.9
	Nitrogen, As Ammonia	IW-12-20050419	N	4/19/2005	2.8	0.99	1.9
	Nitrogen, As Ammonia	IW-12-20050518	N	5/18/2005	2.5	0.99	1.9
	Nitrogen, As Ammonia	IW-12-20050615	N	6/15/2005	2.7	0.99	1.9
	Nitrogen, As Ammonia	IW-12-20050817	N	8/17/2005	2.1	0.99	1.9
	Nitrogen, As Ammonia	IW-12-20050921	N	9/21/2005	1.9	0.99	1.9
	Nitrogen, As Ammonia	IW-12-20051019	N	10/19/2005	2.4	0.99	1.9
IW-13	Nitrogen, As Ammonia	IW-12-20051116	N	11/16/2005	2.4	0.99	1.9
	Nitrogen, As Ammonia	IW-12-20051221	N	12/21/2005	2.6	0.99	1.9
	Nitrogen, As Ammonia	IW-12-20060118	N	1/18/2006	2.5	0.99	1.9
	Nitrogen, As Ammonia	IW-12-20060217	N	2/17/2006	2.9	0.99	1.9
	Nitrogen, As Ammonia	IW-12-20060315	N	3/15/2006	2.5	0.99	1.9
	Nitrogen, As Ammonia	IW-12-20060420	N	4/20/2006	2.4	0.99	1.9
	Nitrogen, As Ammonia	IW-12-20060510	N	5/10/2006	2.1	0.99	1.9
	Nitrogen, As Ammonia	IW-13-19881208	N	12/8/1988	190	0.99	1.9
	Nitrogen, As Ammonia	IW-13-19890501	N	5/1/1989	170	0.99	1.9
	Nitrogen, As Ammonia	IW-13-19891101	N	11/1/1989	100	0.99	1.9
	Nitrogen, As Ammonia	IW-13-19900501	N	5/1/1990	120	0.99	1.9
	Nitrogen, As Ammonia	IW-13-19901121	N	11/21/1990	98	0.99	1.9
	Nitrogen, As Ammonia	IW-13-19901121	FD	11/21/1990	99	0.99	1.9
	Nitrogen, As Ammonia	IW-13-19901127	N	11/27/1990	120	0.99	1.9
	Nitrogen, As Ammonia	IW-13-19901128	N	11/28/1990	120	0.99	1.9

**Table 2-1**  
**Comparison to Ecological Benchmarks for Ammonia**  
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Location	Analyte	Sample ID	Sample Type	Date	Result mg/L	Chronic Benchmark Values (mg/L)	
						30°C, pH 7	20°C, pH 7
IW-13 (cont.)	Nitrogen, As Ammonia	IW-13-19961218	N	12/18/1996	<b>42.3</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-13-20050316	N	3/16/2005	<b>37</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-13-20050419	N	4/19/2005	<b>35</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-13-20050518	N	5/18/2005	<b>34</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-13-20050615	N	6/15/2005	<b>25</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-13-20050817	N	8/17/2005	<b>20</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-13-20050921	N	9/21/2005	<b>25</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-13-20051019	N	10/19/2005	<b>27</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-13-20051116	N	11/16/2005	<b>29</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-13-20051221	N	12/21/2005	<b>26</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-13-20060118	N	1/18/2006	<b>25</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-13-20060217	N	2/17/2006	<b>32</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-13-20060315	N	3/15/2006	<b>35</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-13-20060420	N	4/20/2006	<b>33</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-13-20060510	N	5/10/2006	<b>29</b>	0.99	1.9
IW-2	Nitrogen, As Ammonia	1W2	N	9/30/2003	0.1	0.99	1.9
IW-3	Nitrogen, As Ammonia	1W3	N	9/30/2003	0.1	0.99	1.9
IW-6	Nitrogen, As Ammonia	IW-6-19970724	FD	7/24/1997	<b>1.1</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-6-19970724	N	7/24/1997	<b>1.15</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-6-19970930	N	9/30/1997	0.92	0.99	1.9
	Nitrogen, As Ammonia	IW6	N	2/13/1998	0.5	0.99	1.9
	Nitrogen, As Ammonia	IW-6-19981021	N	10/21/1998	<b>1</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-6-19990218	N	2/18/1999	0.86	0.99	1.9
	Nitrogen, As Ammonia	IW-6-19990526	N	5/26/1999	<b>1.2</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-6-19990806	N	8/6/1999	<b>1</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-6-20000810	N	8/10/2000	<b>1.1</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-6-20010523	N	5/23/2001	0.46	0.99	1.9
	Nitrogen, As Ammonia	IW-6-20010816	N	8/16/2001	0.66	0.99	1.9
	Nitrogen, As Ammonia	IW-6-20020816	N	8/16/2002	0.36	0.99	1.9
	Nitrogen, As Ammonia	IW-6-20030821	N	8/21/2003	0.58	0.99	1.9
	Nitrogen, As Ammonia	IW-6-20040819	N	8/19/2004	<b>1.5</b>	0.99	1.9
	Nitrogen, As Ammonia	IW-6-20050803	N	8/3/2005	0.9	0.99	1.9
	Nitrogen, As Ammonia	OC-IW-6-20071115	N	11/15/2007	<b>1.1</b>	0.99	1.9
	Nitrogen, As Ammonia	OC-IW-6-20081124	N	11/24/2008	0.57	0.99	1.9
	Nitrogen, As Ammonia	OC-IW-6-20091112	N	11/12/2009	0.53	0.99	1.9
	Nitrogen, As Ammonia	OC-IW-6-20101118	N	11/18/2010	0.61	0.99	1.9
	Nitrogen, As Ammonia	OC-IW-6-20111109	N	11/9/2011	0.2	0.99	1.9
	Nitrogen, As Ammonia	OC-IW-6-20121114	N	11/14/2012	0.49	0.99	1.9
	Nitrogen, As Ammonia	OC-IW-6-20131120	N	11/20/2013	0.5	0.99	1.9
P5	Nitrogen, As Ammonia	P5-20030929	N	9/29/2003	<b>6.03</b>	0.99	1.9

**Bold** = exceeds benchmark at 30°C

Highlight = exceeds benchmark at 20°C and 30°C

**Table 2-2**  
**Groundwater/Surface Water Field Parameters**  
**Olin Chemical Superfund Site**  
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Location ID	Sample ID	Date	pH	temperature
South Ditch Surface Water				
ISCO-1	OC-SW-ISCO1	5/25/2016	6.01	15.25
	OC-SW-ISCO1	11/15/2017	7.07	5.17
	OC-SW-ISCO2	5/25/2016	6.1	15.23
ISCO-2	OC-SW-ISCO2	11/15/2017	7.01	6.51
	OC-SW-ISCO2	5/22/2018	7.09	18.12
	OC-SW-ISCO2	12/4/2018	5.63	6.11
ISCO-3	OC-SW-ISCO3	5/25/2016	7.83	17.48
	OC-SW-ISCO3	11/15/2017	7.13	8.58
	OC-SW-ISCO3	5/22/2018	5.81	20.39
PZ-16RRR	OC-SW-PZ16RRR	5/25/2016	6.31	14.34
	OC-SW-PZ16RRR	11/15/2017	7.48	7.77
	OC-SW-PZ16RRR	5/22/2018	7.85	17.07
	OC-SW-PZ16RRR	12/4/2018	5.6	5.7
PZ-17RRR	OC-SW-PZ17RRR	5/25/2016	6.35	14.65
	OC-SW-PZ17RRR	11/15/2017	7.76	8.49
	OC-SW-PZ17RRR	5/22/2018	9.03	17.3
	OC-SW-PZ17RRR	12/4/2018	6.2	6.12
PZ-18R	OC-SW-PZ18RR	5/25/2016	8.05	15.2
	OC-SW-PZ18RR	11/15/2017	7.18	5.1
	OC-SW-PZ18RR	5/22/2018	9.01	14.99
	OC-SW-PZ18RR	12/4/2018	6.55	5.98
SD-17	OC-SW-SD17	5/25/2016	6.45	14.73
	OC-SW-SD17	11/15/2017	7.8	8.45
	OC-SW-SD17	5/22/2018	8.83	15.41
	OC-SW-SD17	12/4/2018	6.2	6.19
Average value:			7.1	11.6
East Ditch Surface Water - Plant B area				
EDSD/SW2	OC-SW-EDSD-SW2-EDBS6-XXXX	12/13/2010	7.19	9.07
	OC-SW-EDSD-SW2-EDBS6-XXXX	6/8/2011	7.28	18.64
Average value:			7.2	13.9

**Table 2-2**  
**Groundwater/Surface Water Field Parameters**  
**Olin Chemical Superfund Site**  
**Page 2 of 2**

Groundwater Close to Plant B and East Ditch (recent values)				
B-03	OC-B-03-20121114	11/14/2012	6.26	
	OC-B-03-20131119	11/19/2013	5.56	
	OC-B-03-20141105	11/5/2014	5.43	
	OC-B-03-20151105	11/5/2015	6.8	
	OC-B-03-20151105	11/5/2015	5.83	
	OC-B-03-20161206	12/6/2016	5.5	
GW-101	OC-GW-101-XXX-20100512	5/12/2010	6.05	10.79
	OC-GW-101-20101118	11/18/2010	6.44	
	OC-GW-101-20111109	11/9/2011	6.11	
	OC-GW-101-20121115	11/15/2012	6.67	
	OC-GW-101-20131120	11/20/2013	6.06	
	OC-GW-101-20141105	11/5/2014	6.04	
	OC-GW-101-20151105	11/5/2015	6.58	
	OC-GW-101-20161206	12/6/2016	6.5	
GW-13	OC-GW-13-XXX-20100510	5/10/2010	5.17	11.18
	OC-GW-13-XXX-20101012	10/12/2010		
	OC-GW-13-20101118	11/18/2010	5.77	
	OC-GW-13-20111110	11/10/2011	5.74	
	OC-GW-13-20121114	11/14/2012	6.21	
	OC-GW-13-20131120	11/20/2013	5.17	
	OC-GW-13-20141105	11/5/2014	5.24	
	OG-GW-13-20151105	11/5/2015	5.34	
GW-14	OC-GW-13-20161206	12/6/2016	5.4	
	GW-14-19970724	7/24/1997	6.79	
	GW-14-19971001	10/1/1997	7.54	
GW-15	OC-GW-14-XXX-20100513	5/13/2010	5.3	11.1
	GW-15-20000118	1/18/2000	8.25	
GW-16	OC-GW-15-XXX-20100513	5/13/2010	5.7	12
	GW16	8/21/2007	6.03	
	GW16	8/21/2007	5.96	
	OC-GW-16-20071115	11/15/2007	6.01	
	OC-GW-16-20071115	11/15/2007	5.91	
	OC-GW-16R-20130510	5/10/2013	6.17	
GW-52S	GW-52S-20000118	1/18/2000	6.72	
	OC-GW-52S-XXX-20100513	5/13/2010	6.2	9.6
Average value:			6.1	10.9

**Table 2-3**  
**Groundwater Analytical Results Compared to NRWQC - Detected Analytes 2010-Present**  
**Olin Chemical, Wilmington, Massachusetts**  
**Page 1 of 3**

Sample Location				B-03										B-07-A			GW-13									
Sample Date				05/10/10	10/11/10	11/18/10	11/09/11	11/14/12	11/19/13	11/05/14	11/05/15		12/06/16	05/12/10	10/11/10	05/10/10	10/12/10	11/18/10	11/10/11	11/14/12	11/20/13	11/05/14	11/05/15	12/06/16		
Sample Type				N	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
Sample ID	Units	NRWQC	Ammonia (30°C, pH 7)	Ammonia (20°C, pH 7)	OC-B-03-XXX-20100510	OC-B-03-XXX-20101011	OC-B-03-20101118	OC-B-03-20111109	OC-B-03-20121114	OC-B-03-20131119	OC-B-03-20141105	OC-DUP-3-GW-20151105	OC-B-03-20161206	OC-B-07-A-XXX-20100512	OC-B-07-A-XXX-20101011	OC-GW-13-XXX-20100510	OC-GW-13-XXX-20101012	OC-GW-13-20101118	OC-GW-13-20111110	OC-GW-13-20121114	OC-GW-13-20131120	OC-GW-13-20141105	OC-GW-13-20151105	OC-GW-13-20161206		
<b>Total Metals</b>																										
Aluminum	ug/L	87	--	--	300	89 J	NA	NA	NA	NA	NA	NA	NA	170	100 U	65 J	120	NA	NA	NA						
Arsenic	ug/L	150	--	--	1 U	1 U	NA	NA	NA	NA	NA	NA	NA	1 U	0.79 J	1 U	1 U	NA	NA	NA						
Cadmium	ug/L	0.72	--	--	1 U	0.14 J	NA	NA	NA	NA	NA	NA	NA	0.22 U	0.23 J	0.2 J	0.37 J	NA	NA	NA						
Chromium	ug/L	74	--	--	5 U	1 U	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	5 U	0.71 U	NA	NA	NA						
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	ug/L	1000	--	--	110	210	NA	NA	NA	NA	NA	NA	NA	100 U	100 U	170	350	NA	NA	NA						
Lead	ug/L	2.5	--	--	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	2.3 J	1.7 J	5 U	5 U	NA	NA	NA						
Mercury	ug/L	0.77	--	--	0.2 U	0.24 U	NA	NA	NA	NA	NA	NA	NA	0.2 U	0.2 U	0.2 U	0.34 U	NA	NA	NA						
Nickel	ug/L	52	--	--	2.8 J	1.2 J	NA	NA	NA	NA	NA	NA	NA	6 J	10 U	1.6 J	3.1 J	NA	NA	NA						
Zinc	ug/L	120	--	--	14 J	8.7 J	NA	NA	NA	NA	NA	NA	NA	14 J	21 J	93	130	NA	NA	NA						
<b>Dissolved Metals</b>																										
Aluminum	ug/L	87	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	ug/L	150	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	ug/L	0.72	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	ug/L	74	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	ug/L	1000	--	--	NA	NA	100 U	17 J	50 U	50 U	50 U	50 U	31 J	31 J	50 U	NA	NA	NA	NA	100 U	70 J	45 J	50 U	130	180	680
Lead	ug/L	2.5	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	ug/L	52	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	ug/L	120	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>General Chemistry</b>																										
Ammonia	mg/L	--	0.99	1.9	NA	NA	NA	NA	NA	NA	0.57	0.34 J	0.2	0.4	NA	NA	NA	NA	NA	NA	NA	0.2 U	0.11 J	0.11 J		
Chloride	mg/L	230	--	--	2	1.5	NA	NA	NA	NA	NA	NA	NA	4.2	2.1	4.5	13	NA	NA	NA						
Nitrogen, As Ammonia	mg/L	--	0.99	1.9	0.17	0.12 U	0.21	0.34	0.02 U	0.02	NA	NA	NA	0.18	0.77 U	0.2	0.33 U	0.1 U	0.19	0.02 U	0.02 U	NA	NA	NA	NA	NA

Color - Standard Exceeded; Bold - Detected; U - Not Detected;  
J - Estimated; R - Rejected; NA - Not Analyzed

**Table 2-3**  
**Groundwater Analytical Results Compared to NRWQC - Detected Analytes 2010-Present**  
**Olin Chemical, Wilmington, Massachusetts**  
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Sample Location				GW-14		GW-15		GW-16	GW-52S		GW-101									
Sample Date				05/13/10	10/13/10	05/13/10	10/12/10	05/10/13	05/13/10	10/13/10	05/12/10	10/11/10	11/18/10	11/09/11	11/15/12	11/20/13	11/05/14	11/05/15	12/06/16	
Sample Type				N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
Sample ID	Units	NRWQC	Ammonia (30°C, pH 7)	Ammonia (20°C, pH 7)	OC-GW-14-XXX-20100513	OC-GW-14-XXX-20101013	OC-GW-15-XXX-20100513	OC-GW-15-XXX-20101012	OC-GW-16R-20130510	OC-GW-52S-XXX-20100513	OC-GW-52S-XXX-20100512	OC-GW-101-XXX-20101013	OC-GW-101-XXX-20101011	OC-GW-101-20101118	OC-GW-101-20111109	OC-GW-101-20121115	OC-GW-101-20131120	OC-GW-101-20141105	OC-GW-101-20151105	OC-GW-101-20161206
<b>Total Metals</b>																				
Aluminum	ug/L	87	--	--	2100	680	1000	5200	NA	78 J	19 J	100 U	100 U	NA	NA	NA	NA	NA	NA	
Arsenic	ug/L	150	--	--	0.59 J	2 U	10 U	16	NA	0.89 J	2.5	5.9	18 J	NA	NA	NA	NA	NA	NA	
Cadmium	ug/L	0.72	--	--	1 U	0.33 J	0.32 U	0.36 J	NA	1 U	0.18 J	1 U	1 U	NA	NA	NA	NA	NA	NA	
Chromium	ug/L	74	--	--	3.3 U	7.5	14	56	NA	7.4 U	6.2	5 U	5 U	NA	NA	NA	NA	NA	NA	
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA	NA	NA	0.96 J	1 U	1 U	0.71 J	NA	NA	NA	NA	NA	NA	
Iron	ug/L	1000	--	--	420	550	780	7100	NA	51 J	140	2100	6000	NA	NA	NA	NA	NA	NA	
Lead	ug/L	2.5	--	--	8.7	2.3 J	1.5 J	3.5 J	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	NA	NA	
Mercury	ug/L	0.77	--	--	0.2 U	0.2 U	0.2 U	0.2 U	NA	0.2 U	0.17 J	0.2 U	0.085 U	NA	NA	NA	NA	NA	NA	
Nickel	ug/L	52	--	--	3.7 J	7.3 J	16	26	NA	10 U	2.8 J	3.8 J	7 J	NA	NA	NA	NA	NA	NA	
Zinc	ug/L	120	--	--	14 J	50 U	11 J	16 J	NA	50 U	50 U	50 U	20 J	NA	NA	NA	NA	NA	NA	
<b>Dissolved Metals</b>																				
Aluminum	ug/L	87	--	--	NA	NA	NA	960	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Arsenic	ug/L	150	--	--	NA	NA	NA	7.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Cadmium	ug/L	0.72	--	--	NA	NA	NA	0.19 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chromium	ug/L	74	--	--	NA	NA	NA	18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Iron	ug/L	1000	--	--	NA	NA	NA	430	2000	NA	NA	NA	NA	6300	7500	3900	6600	6800	5900	14000
Lead	ug/L	2.5	--	--	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Nickel	ug/L	52	--	--	NA	NA	NA	17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Zinc	ug/L	120	--	--	NA	NA	NA	50 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>General Chemistry</b>																				
Ammonia	mg/L	--	0.99	1.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.9	1.4	1.9	1.9	
Chloride	mg/L	230	--	--	2	2.9	2.3	3.4	NA	1.7	2.9	19	610	NA	NA	NA	NA	NA	NA	
Nitrogen, As Ammonia	mg/L	--	0.99	1.9	0.24	13	26	69	4.8	1.3	2.9	1.9	1.7	0.95	1.2	6	4.8	NA	NA	

Color - Standard Exceeded; Bold - Detected; U - Not Detected;  
J - Estimated; R - Rejected; NA - Not Analyzed

**Table 2-3**  
**Groundwater Analytical Results Compared to NRWQC - Detected Analytes 2010-Present**  
**Olin Chemical, Wilmington, Massachusetts**  
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Sample Location				IW-6							IW-10							
Sample Date				11/18/10	11/09/11	11/14/12	11/20/13	11/05/14	11/05/15	12/06/16	11/18/10	11/09/11	11/14/12	11/19/13	11/05/14	11/06/15	12/06/16	
Sample Type				N	N	N	N	N	N	N	N	N	N	N	N	N	N	
Sample ID	Units	NRWQC	Ammonia (30°C, pH 7)	Ammonia (20°C, pH 7)	OC-IW-6-20101118	OC-IW-6-20111109	OC-IW-6-20121114	OC-IW-6-20131120	OC-IW-6-20141105	OC-IW-6-20151105	OC-IW-6-20161206	OC-IW-10-20101118	OC-IW-10-20111109	OC-IW-10-20121114	OC-IW-10-20131119	OC-IW-10-20141105	OC-IW-10-20151106	OC-IW-10-20161206
<b>Total Metals</b>																		
Aluminum	ug/L	87	--	--	NA	NA	NA	NA	NA	NA								
Arsenic	ug/L	150	--	--	NA	NA	NA	NA	NA	NA								
Cadmium	ug/L	0.72	--	--	NA	NA	NA	NA	NA	NA								
Chromium	ug/L	74	--	--	NA	NA	NA	NA	NA	NA								
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA	NA	NA	NA								
Iron	ug/L	1000	--	--	NA	NA	NA	NA	NA	NA								
Lead	ug/L	2.5	--	--	NA	NA	NA	NA	NA	NA								
Mercury	ug/L	0.77	--	--	NA	NA	NA	NA	NA	NA								
Nickel	ug/L	52	--	--	NA	NA	NA	NA	NA	NA								
Zinc	ug/L	120	--	--	NA	NA	NA	NA	NA	NA								
<b>Dissolved Metals</b>																		
Aluminum	ug/L	87	--	--	NA	NA	NA	NA	NA	NA								
Arsenic	ug/L	150	--	--	NA	NA	NA	NA	NA	NA								
Cadmium	ug/L	0.72	--	--	NA	NA	NA	NA	NA	NA								
Chromium	ug/L	74	--	--	NA	NA	NA	NA	NA	NA								
Iron	ug/L	1000	--	--	8000	3100	8000	5300	9200	6000	16000	58 J	750	26 J	5000	710	100	250
Lead	ug/L	2.5	--	--	NA	NA	NA	NA	NA	NA								
Nickel	ug/L	52	--	--	NA	NA	NA	NA	NA	NA								
Zinc	ug/L	120	--	--	NA	NA	NA	NA	NA	NA								
<b>General Chemistry</b>																		
Ammonia	mg/L	--	0.99	1.9	NA	NA	NA	NA	0.67 J	0.59	0.65	NA	NA	NA	48	66	79	
Chloride	mg/L	230	--	--	NA	NA	NA	NA	NA	NA								
Nitrogen, As Ammonia	mg/L	--	0.99	1.9	0.61	0.2	0.49	0.5	NA	NA	NA	56	60	68	57	NA	NA	NA

Color - Standard Exceeded; Bold - Detected; U - Not Detected;  
J - Estimated; R - Rejected; NA - Not Analyzed

**TABLE 4.1**  
**VALUES USED FOR DAILY INTAKE CALCULATIONS - ADOLESCENT TRESPASSER CONTACT WITH SURFACE WATER**

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Surface water
Receptor Population: trespasser
Receptor Age: Adolescent age 6-16 yrs

Exposure Route	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Intake Equation/Model Name
Ingestion	Surface Water	EPC IRW FI EF ED CF BW AT <sub>NC</sub>	Exposure Point Concentration Ingestion Rate of Water Fraction Ingested Exposure Frequency Exposure Duration Conversion Factor Body Weight Averaging Time (Non-Cancer)	µg/L L/day unitless days/year years mg/µg kg days	COPC-specific 0.1 1 26 10 1.00E-03 ---- EPA, 2014 ED x 365 days/year	Table A-3.1 Professional judgment Professional judgment Professional judgment Professional judgment ----- ED x 365 days/year	Chronic daily intake (CDI) (mg/kg-day) = EPC x IRW x CF x FI x EF x ED x 1/BW x 1/AT <sub>NC</sub>
Dermal	Surface Water	DA <sub>event</sub> SA EV EF ED BW AT-C AT-N CW Kp CF FA t <sup>*</sup> τ <sub>event</sub> B t <sub>event</sub>	Absorbed Dose Per Event Contact Event Frequency Exposure Frequency Exposure Duration Body Weight Averaging Time (Cancer) Averaging Time (Non-Cancer) Chemical Concentration in Water Dermal Permeability Coefficients Conversion Factor Fraction Absorbed Water Time to Reach Steady State Lag Time Per Event Ratio of Permeability Coefficient Event Duration	mg/cm <sup>2</sup> -event cm <sup>2</sup> event/day days/year years kg days days µg/L cm/hr mg-L/µg-cm <sup>3</sup> unitless hr/event hr/event unitless hr/event	COPC-specific 3,285 1 26 10 44 25,550 3,650 COPC-specific COPC-Specific 1.00E-06 COPC-Specific COPC-Specific COPC-Specific COPC-Specific -- Table A-3.1 Table D-1 Table D-1 Table D-1 Table D-1 Table D-1 Table D-1 Professional judgment	Table D-1 EPA, 2014 Professional judgment Professional judgment Professional judgment EPA, 2014 EPA, 1989 ED x 365 days/year Table A-3.1 Table D-1 Table D-1 Table D-1 Table D-1 Table D-1 Professional judgment	Dermal Absorbed Dose (mg/kg-day) = DA <sub>event</sub> x SA x EV x EF x ED / (BW x AT)  for inorganics: DA <sub>event</sub> = CW x Kp x t <sub>event</sub> x CF Equations for DA <sub>event</sub> for organics: If t <sub>event</sub> < t <sup>*</sup>  DA <sub>event</sub> =2FAX Kpx CWx CF $\sqrt{\frac{6 \times \tau_{event} \times t_{event}}{\pi}}$  If t <sub>event</sub> > t <sup>*</sup>  DA <sub>event</sub> =FAX Kpx CWx CFx $\left[ \frac{t_{event}}{1+B} + 2\tau_{event} \left( \frac{1+3B+3B^2}{(1+B)^2} \right) \right]$

**RAGS TABLE 4.2**  
**VALUES USED FOR DAILY INTAKE CALCULATIONS - UTILITY WORKER CONTACT WITH GROUNDWATER**

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Shallow Groundwater/Trench Air
Receptor Population: Utility Worker
Receptor Age: Adult

Exposure Route	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Shallow Groundwater in construction trenches	EPC IRW FI EF ED CF BW AT <sub>NC</sub>	Exposure Point Concentration Ingestion Rate of Water Fraction Ingested Exposure Frequency Exposure Duration Conversion Factor Body Weight Averaging Time (Non-Cancer)	µg/L L/day unitless days/year years mg/µg kg days	COPC-specific 0.05 1 20 0.08 1.00E-03 80 29	Table A-3.1 Professional judgment Professional judgment Professional judgment Professional judgment ----- EPA, 2014 ED x 365 days/year	Chronic daily intake (CDI) (mg/kg-day) = $EPC \times IRW \times CF \times FI \times EF \times ED \times 1/BW \times 1/AT_{NC}$
Dermal	Shallow Groundwater in construction trenches	DA <sub>event</sub> SA EV EF ED BW AT-C AT-N CW Kp CF FA t <sup>*</sup> τ <sub>event</sub> B t <sub>event</sub>	Absorbed Dose Per Event Contact Event Frequency Exposure Frequency Exposure Duration Body Weight Averaging Time (Cancer) Averaging Time (Non-Cancer) Chemical Concentration in Water Dermal Permeability Coefficients Conversion Factor Fraction Absorbed Water Time to Reach Steady State Lag Time Per Event Ratio of Permeability Coefficient Event Duration	mg/cm <sup>2</sup> -event cm <sup>2</sup> event/day days/year years kg days days µg/L cm/hr mg-L/µg-cm <sup>3</sup> unitless hr/event hr/event unitless hr/event	COPC-specific 3,527 1 20 0.08 25,550 29 COPC-specific COPC-Specific 1.00E-06 COPC-Specific COPC-Specific COPC-Specific 8	Table D-1 EPA, 2014 Professional judgment Professional judgment Professional judgment EPA, 2014 EPA, 1989 ED x 365 days/year Table A-3.1 Table D-1 -- Table D-1 Table D-1 Table D-1 Table D-1 Professional judgment	Dermal Absorbed Dose (mg/kg-day) = $DA_{event} \times SA \times EV \times EF \times ED / (BW \times AT)$ for inorganics: $DA_{event} = CW \times Kp \times t_{event} \times CF$ Equations for DA <sub>event</sub> for organics: If $t_{event} < t^*$ $DA_{event} = 2FAX Kpx CWx CF \sqrt{\frac{6 \times \tau_{event} \times t_{event}}{\pi}}$ If $t_{event} > t^*$ $DA_{event} = FAX Kpx CWx CFx \left[ \frac{t_{event} + 2\tau_{event} \left( \frac{1+3B+3B^2}{(1+B)^2} \right)}{1+B} \right]$
Inhalation	Vapors in construction trenches	EC Cair CF1 ET EF ED AT-C AT-N	Exposure Concentrations Air Conversion Factor Exposure Time Exposure Frequency Exposure Duration Averaging Time (Cancer) Averaging Time (Non-Cancer)	mg/m <sup>3</sup> mg/m <sup>3</sup> 1 day/24 hours hrs/day days/year years days days	Calculated COPC-specific 4.17E-02 8 20 0.08 25,550 29	----- Table C-1 ----- Professional judgment Professional judgment Professional judgment EPA, 1989 ED x 365 days/year	Exposure Concentration (EC) (mg/m <sup>3</sup> ) = $Cair \times ET \times EF \times ED \times CF1/AT$ Cair modeled from shallow groundwater using the Virginia Department of Environmental Quality model

**Attachment B**  
**Groundwater Analytical Results Compared to NRWQC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**  
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Sample Location					B-05-R	B-07-A		B-03																			
Sample Date					04/03/03	05/12/10	10/11/10	08/12/92	11/10/92	12/02/97	02/13/98	05/14/98	08/11/98	10/21/98		02/18/99		05/26/99	08/06/99	08/10/00	08/15/01	08/15/02	08/20/03	08/19/04	08/03/05		
Sample Type					N	N	N	N	N	N	N	N	N	FD	N	FD	N	N	N	N	N	N	N	N			
Sample ID	Units	NRWQC	Ammonia (30°C, pH 7)	Ammonia (20°C, pH 7)	B-5R	OC-B-07-A-XXX-20100512	OC-B-07-A-XXX-20101011	B-03-19920812	B-03-19921110	B-3/GW-14	B-3-19980213	B-3-19980514	B-3-19980811	B-3-19981021	BLIND DUPLICATE-19981021	B-3-19990218	BLIND DUPLICATE-19990218	B-03-19990526	B-3-19990806	B-3-20000810	B-3-20010815	B-3-20020815	B-3-20030820	B-3-20040819	B-3-20050803		
<b>Semivolatiles</b>																											
Pentachlorophenol	ug/L	15	--	--	50 U	0.97 U	0.91 U	25 U	25 U	1250 U	500 U	1250 U	500 U	250 U	1250 U	48 U	49 U	100 U	50 U	50 U	50 U	NA	NA	NA	NA		
<b>Pesticides/PCBs</b>																											
4,4'-DDT	ug/L	0.001	--	--	NA	NA	NA	0.1 U	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Dieldrin	ug/L	0.056	--	--	NA	NA	NA	0.1 U	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Endosulfan I	ug/L	0.056	--	--	NA	NA	NA	0.05 U	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Endosulfan II	ug/L	0.056	--	--	NA	NA	NA	0.1 U	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Endrin	ug/L	0.036	--	--	NA	NA	NA	0.1 U	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Heptachlor	ug/L	0.0038	--	--	NA	NA	NA	0.05 U	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Heptachlor Epoxide	ug/L	0.0038	--	--	NA	NA	NA	0.05 U	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Methoxychlor	ug/L	0.03	--	--	NA	NA	NA	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Toxaphene	ug/L	0.0002	--	--	NA	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>Total Metals</b>																											
Aluminum	ug/L	87	--	--	NA	170	100 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Arsenic	ug/L	150	--	--	NA	1 U	0.79 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Cadmium	ug/L	0.72	--	--	NA	0.22 U	0.23 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chromium	ug/L	74	--	--	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chromium-Hexavalent	ug/L	11	--	--	NA	1 U	1 UU	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Iron	ug/L	1000	--	--	NA	100 U	100 U	NA	NA	NA	485	NA	NA	NA	NA	140	130	220	120	50 U	74	NA	NA	NA	NA		
Lead	ug/L	2.5	--	--	NA	2.3 J	1.7 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Mercury	ug/L	0.77	--	--	NA	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Nickel	ug/L	52	--	--	NA	6 J	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Zinc	ug/L	120	--	--	NA	14 J	21 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>Dissolved Metals</b>																											
Aluminum	ug/L	87	--	--	NA	NA	NA	100 U	100 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Arsenic	ug/L	150	--	--	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Cadmium	ug/L	0.72	--	--	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chromium	ug/L	74	--	--	NA	NA	NA	15 U	15 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Iron	ug/L	1000	--	--	NA	NA	NA	85	49	12500	NA	54	84	270	530	NA	NA	NA	NA	NA	NA	NA	NA	797	973	64	100
Lead	ug/L	2.5	--	--	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Mercury	ug/L	0.77	--	--	NA	NA	NA	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Nickel	ug/L	52	--	--	NA	NA	NA	40 U	40 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Zinc	ug/L	120	--	--	NA	NA	NA	25 U	38	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>General Chemistry</b>																											

**Attachment B**  
**Groundwater Analytical Results Compared to NRWQC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**  
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Sample Location		B-03 (cont.)																		GW-13									
Sample Date				11/15/07	11/24/08	11/12/09	05/10/10	10/11/10	11/18/10	11/09/11	11/14/12	11/19/13	11/05/14	11/05/15		12/06/16	03/01/81	04/01/81	05/01/81	06/01/81	08/01/81	10/01/82	06/01/83	10/01/83					
Sample Type				N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
Sample ID	Units	NRWQC	Ammonia (30°C, pH 7)	Ammonia (20°C, pH 7)	OC-B-03-20071115	OC-B-03-20081124	OC-B-03-20091112	OC-B-03-XXX-20100510	OC-B-03-20101118	OC-B-03-20111109	OC-B-03-20121114	OC-B-03-20131119	OC-B-03-20141105	OC-B-03-20151105	OC-DUP-3-GW-20151105	OC-B-03-20161206	GW-13-19810301	GW-13-19810401	GW-13-19810501	GW-13-19810601	GW-13-19810801	GW-13-19821001	GW-13-19830601	GW-13-19831001					
<b>Semivolatiles</b>																													
Pentachlorophenol	ug/L	15	--	--	NA	NA	NA	0.95 U	0.91 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>Pesticides/PCBs</b>																													
4,4'-DDT	ug/L	0.001	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Dieldrin	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Endosulfan I	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Endosulfan II	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Endrin	ug/L	0.036	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Heptachlor	ug/L	0.0038	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Heptachlor Epoxide	ug/L	0.0038	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Methoxychlor	ug/L	0.03	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Toxaphene	ug/L	0.0002	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>Total Metals</b>																													
Aluminum	ug/L	87	--	--	NA	NA	NA	300	89 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Arsenic	ug/L	150	--	--	NA	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Cadmium	ug/L	0.72	--	--	NA	NA	NA	1 U	0.14 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chromium	ug/L	74	--	--	NA	NA	NA	5 U	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Iron	ug/L	1000	--	--	NA	73 J	NA	110	210	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Lead	ug/L	2.5	--	--	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Mercury	ug/L	0.77	--	--	NA	NA	NA	0.2 U	0.24 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Nickel	ug/L	52	--	--	NA	NA	NA	2.8 J	1.2 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Zinc	ug/L	120	--	--	NA	NA	NA	14 J	8.7 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>Dissolved Metals</b>																													
Aluminum	ug/L	87	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Arsenic	ug/L	150	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Cadmium	ug/L	0.72	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chromium	ug/L	74	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Iron	ug/L	1000	--	--	NA	860	100 U	110	NA	NA	100 U	17 J	50 U	50 U	50 U	31 J	31 J	50 U	NA	NA	NA	NA							

**Attachment B**  
**Groundwater Analytical Results Compared to NRWQC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**  
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Color - Standard Exceeded; Bold - Detected; U - Not Detected; -- No Standard  
J - Estimated; R - Rejected; NA - Not Analyzed

**Attachment B**  
**Groundwater Analytical Results Compared to NRWQC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**  
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**Attachment B**  
**Groundwater Analytical Results Compared to NRWQC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**  
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J - Estimated; R - Rejected; NA - Not Analyzed

**Attachment B**  
**Groundwater Analytical Results Compared to NRWQC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**  
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Sample Location		GW-15 (cont.)															GW-16														
Sample Date																															
Sample Type																															
Sample ID	Units	NRWQC	Ammonia (30°C, pH 7)	Ammonia (20°C, pH 7)	GW-15-19831001	GW-15-19840701	GW-15-19841201	GW-15-19850501	GW-15-19870601	GW-15-19880519	GW-15-19900501	GW-15-20000118	OC-GW-15-XXX-20100513	OC-GW-15-XXX-20101012	GW-16-19810301	GW-16-19810401	GW-16-19810501	GW-16-19810601	GW-16-19810801	GW-16-19861201	GW-16-19870601	GW-16-19871201	GW-16-19880519	GW-16-19900501	GW-16-19970724						
<b>Semivolatiles</b>																															
Pentachlorophenol	ug/L	15	--	--	NA	54 U	R	0.91 U	NA	NA	NA	NA	100 U																		
<b>Pesticides/PCBs</b>																															
4,4'-DDT	ug/L	0.001	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										
Dieldrin	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										
Endosulfan I	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										
Endosulfan II	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										
Endrin	ug/L	0.036	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										
Heptachlor	ug/L	0.0038	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										
Heptachlor Epoxide	ug/L	0.0038	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										
Methoxychlor	ug/L	0.03	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										
Toxaphene	ug/L	0.0002	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										
<b>Total Metals</b>																															
Aluminum	ug/L	87	--	--	NA	1000	5200	NA	NA	NA	NA	NA																			
Arsenic	ug/L	150	--	--	NA	10 U	16	NA	NA	NA	NA	NA																			
Cadmium	ug/L	0.72	--	--	NA	0.32 U	0.36 J	NA	NA	NA	NA	NA																			
Chromium	ug/L	74	--	--	NA	62	19	NA	NA	14	56	NA	15 U	15 U	NA	NA															
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA	NA	NA	150	NA	NA	NA	NA	NA	NA															
Iron	ug/L	1000	--	--	NA	780	7100	NA	NA	NA	NA	13600																			
Lead	ug/L	2.5	--	--	NA	1.5 J	3.5 J	NA	NA	NA	NA	NA																			
Mercury	ug/L	0.77	--	--	NA	0.2 U	0.2 U	NA	NA	NA	NA	NA																			
Nickel	ug/L	52	--	--	NA	16	26	NA	NA	NA	NA	NA																			
Zinc	ug/L	120	--	--	NA	11 J	16 J	NA	NA	NA	NA	NA																			
<b>Dissolved Metals</b>																															
Aluminum	ug/L	87	--	--	NA	1700	960	NA	NA	NA	NA	NA																			
Arsenic	ug/L	150	--	--	NA	7.2	NA	NA	NA	NA	NA																				
Cadmium	ug/L	0.72	--	--	NA	2 U	NA	0.19 J	NA	NA	NA	NA	NA																		
Chromium	ug/L	74	--	--	NA	130	47	NA	NA	18	NA	NA	NA	NA	15 U	15 U															
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										
Iron	ug/L	1000	--	--	NA	NA	NA																								

**Attachment B**  
**Groundwater Analytical Results Compared to NRWQC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**

Color - Standard Exceeded; Bold - Detected; U - Not Detected; -- No Standard  
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**Attachment B**  
**Groundwater Analytical Results Compared to NRWQC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**  
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Color - Standard Exceeded; Bold - Detected; U - Not Detected; -- No Standard  
J - Estimated; R - Rejected; NA - Not Analyzed

**Attachment B**  
**Groundwater Analytical Results Compared to NRWQC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**  
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Sample Location						GW-52S (cont.)		GW-100		GW-101																							
Sample Date				05/13/10 10/13/10		04/03/03 05/23/03		12/02/97		02/13/98		05/14/98		08/11/98		10/21/98		02/18/99		05/26/99		08/06/99		08/10/00		05/23/01		08/16/01		08/15/02		04/03/03	
Sample Type				N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	FD	N	FD	N	N	N	N	N	N	N					
Sample ID	Units	NRWQC	Ammonia (30°C, pH 7)	Ammonia (20°C, pH 7)	OC-GW-52S-XXX-20100513	OC-GW-52S-XXX-20101013	GW-100-20030403	GW-100-20030523	GW-101-19971202	DUP-01	GW-101-19980213	GW-101-19980514	GW-101-19980811	GW-101-19981021	GW-101-19990218	GW-101-19990526	GW-101-19990806	DUPLICATE	GW-101-20000810	BLIND	GW-101-20010523	GW-101-20010816	GW-101-20020815	GW-101-20030403									
<b>Semivolatiles</b>																																	
Pentachlorophenol	ug/L	15	--	--	0.91 U	0.91 U	2500 U	2500 U	250 U	500 U	12500 U	125 U	25 U	250 U	49 U	49 U	50 U	50 U	50 U	50 U	50 U	100 U	50 U	NA	250 U								
<b>Pesticides/PCBs</b>																																	
4,4'-DDT	ug/L	0.001	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Dieldrin	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Endosulfan I	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Endosulfan II	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Endrin	ug/L	0.036	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Heptachlor	ug/L	0.0038	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Heptachlor Epoxide	ug/L	0.0038	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Methoxychlor	ug/L	0.03	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Toxaphene	ug/L	0.0002	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
<b>Total Metals</b>																																	
Aluminum	ug/L	87	--	--	78 J	19 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Arsenic	ug/L	150	--	--	0.89 J	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Cadmium	ug/L	0.72	--	--	1 U	0.18 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Chromium	ug/L	74	--	--	7.4 U	6.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Chromium-Hexavalent	ug/L	11	--	--	0.96 J	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Iron	ug/L	1000	--	--	51 J	140	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Lead	ug/L	2.5	--	--	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Mercury	ug/L	0.77	--	--	0.2 U	0.17 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Nickel	ug/L	52	--	--	10 U	2.8 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Zinc	ug/L	120	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
<b>Dissolved Metals</b>																																	
Aluminum	ug/L	87	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Arsenic	ug/L	150	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Cadmium	ug/L	0.72	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Chromium	ug/L	74	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
Iron	ug/L	1000	--	--	NA	NA	NA	NA	NA	NA	9250	9320	NA	4210	4600	6700	7600	5600	5700	5800	6500	6500	6100	7600	12000	NA							
Lead	ug/L																																

**Attachment B**  
**Groundwater Analytical Results Compared to NRWQC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**  
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Color - Standard Exceeded; Bold - Detected; U - Not Detected; -- No Standard  
J - Estimated; R - Rejected; NA - Not Analyzed

**Attachment B**  
**Groundwater Analytical Results Compared to NRWQC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**  
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Sample Location						GW-102		IW-1		IW-2		IW-3		IW-6												
Sample Date				04/03/03		05/23/03		04/03/03	05/23/03	09/29/03	09/30/03	04/03/03	09/30/03	07/24/97		09/30/97	02/13/98	10/21/98	02/18/99	05/26/99	08/06/99	08/10/00	05/23/01	08/16/01	08/16/02	
Sample Type				N	FD	N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	
Sample ID	Units	NRWQC	Ammonia (30°C, pH 7)	Ammonia (20°C, pH 7)	GW-102	FD-1-20030403	GW102	IW-1	IW1	IWI	IW2	IW3	IW3	IW-6-19970724	BLIND DUPLICATE-19970724	IW6	IW-6-19970930	IW6	IW-6-19981021	IW-6-19990218	IW-6-19990526	IW-6-19990806	IW-6-20000810	IW-6-20010523	IW-6-20010816	IW-6-20020816
<b>Semivolatiles</b>																										
Pentachlorophenol	ug/L	15	--	--	50 U	50 U	50 U	1000 U	250 U	R	2500 U	2500 U	1000 U	50 U	50 U	25 U	25 U	25 U	48 U	49 U	48 U	R	50 U	250 U	NA	
<b>Pesticides/PCBs</b>																										
4,4'-DDT	ug/L	0.001	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	ug/L	0.036	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	ug/L	0.0038	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor Epoxide	ug/L	0.0038	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	ug/L	0.03	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	ug/L	0.0002	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total Metals</b>																										
Aluminum	ug/L	87	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	ug/L	150	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	ug/L	0.72	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	ug/L	74	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	ug/L	1000	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	999	1030	997	828	NA							
Lead	ug/L	2.5	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	ug/L	0.77	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	ug/L	52	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	ug/L	120	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Dissolved Metals</b>																										
Aluminum	ug/L	87	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	ug/L	150	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	ug/L	0.72	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	ug/L	74	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	ug/L	1000	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	ug/L	2.5	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	ug/L	0.77	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	ug/L	52	--	--	NA	NA	NA	NA</																		

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**Groundwater Analytical Results Compared to NRWQC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**  
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Sample Location		IW-6 (cont.)																		IW-10								
Sample Date				08/21/03	08/19/04	08/03/05	11/15/07	11/24/08	11/12/09	11/18/10	11/09/11	11/14/12	11/20/13	11/05/14	11/05/15	12/06/16	07/24/97	09/30/97		12/02/97	05/14/98	08/11/98						
Sample Type				N	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	N	N	N	FD					
Sample ID	Units	NRWQC	Ammonia (30°C, pH 7)	Ammonia (20°C, pH 7)	IW-6-20030821	IW-6-20040819	IW-6-20050803	OC-IW-6-20071115	OC-IW-6-20081124	OC-IW-6-20091112	OC-IW-6-20101118	OC-IW-6-20111109	OC-IW-6-20121114	OC-IW-6-20131120	OC-IW-6-20141105	OC-IW-6-20151105	OC-IW-6-20161206	IW-10-19970724	IW-10-19970930	DUPPLICATE-19970930	IW-10-19971202	IW-10-19980514	IW-10-19980811	BLINDDUPLICATE-19980811				
<b>Semivolatiles</b>																												
Pentachlorophenol	ug/L	15	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	50 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	
<b>Pesticides/PCBs</b>																												
4,4'-DDT	ug/L	0.001	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	ug/L	0.056	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	ug/L	0.036	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	ug/L	0.0038	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor Epoxide	ug/L	0.0038	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	ug/L	0.03	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	ug/L	0.0002	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total Metals</b>																												
Aluminum	ug/L	87	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	ug/L	150	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	ug/L	0.72	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	ug/L	74	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	ug/L	1000	--	--	NA	NA	NA	NA	14000	10000	NA	NA	NA	651	208	127	NA	NA	NA	NA	NA	NA						
Lead	ug/L	2.5	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	ug/L	0.77	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	ug/L	52	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	ug/L	120	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Dissolved Metals</b>																												
Aluminum	ug/L	87	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	ug/L	150	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	ug/L	0.72	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	ug/L	74	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	ug/L	1000	--	--	2490	1800	3400	NA	8600	7200	8000	3100	8000	5300	9200	6000	16000	NA	NA	NA	NA	171	121	50 U	50 U	NA	NA	NA
Lead	ug/L	2.5	--	--	NA	NA	NA																					

**Attachment B**  
**Groundwater Analytical Results Compared to NRWQC - All Results**  
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Color - Standard Exceeded; Bold - Detected; U - Not Detected; -- No Standard  
J - Estimated; R - Rejected; NA - Not Analyzed

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**Groundwater Analytical Results Compared to NRWQC - All Results**  
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Sample Location					IW-11																						
Sample Date					05/19/88	12/08/88	05/01/89	11/01/89	05/01/90	11/21/90	11/27/90	11/28/90	12/21/90	12/17/91	08/12/92	11/10/92	12/18/96	01/24/97	03/16/05	04/19/05	05/18/05	06/15/05	08/17/05	09/21/05	10/19/05	11/16/05	
Sample Type					N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
Sample ID	Units	NRWQC	Ammonia (30°C, pH 7)	Ammonia (20°C, pH 7)	IW-11-19880519	IW-11-19881208	IW-11-19890501	IW-11-19891101	IW-11-19900501	IW-11-19901101	IW-11-19901121	IW-11-19901128	IW-11-19901221	IW-11-19911217	IW-11-19920812	IW-11-19921110	IW-11-19961218	IW-11-19970124	IW-11-20050316	IW-11-20050419	IW-11-20050518	IW-11-20050615	IW-11-20050817	IW-11-20050921	IW-11-20051019	IW-11-20051116	
<strong>Semivolatiles</strong>																											
Pentachlorophenol	ug/L	15	--	--	NA	50 U	50 U	R	8000 U	1000 U	NA																
<strong>Pesticides/PCBs</strong>																											
4,4'-DDT	ug/L	0.001	--	--	NA	1 U	1 U	10 U	NA	0.1 U	NA																
Dieldrin	ug/L	0.056	--	--	NA	1 U	1 U	10 U	NA	0.1 U	NA																
Endosulfan I	ug/L	0.056	--	--	NA	0.5 U	0.7 U	5 U	NA	0.05 U	NA																
Endosulfan II	ug/L	0.056	--	--	NA	1 U	1 U	10 U	NA	0.1 U	NA																
Endrin	ug/L	0.036	--	--	NA	1 U	1 U	10 U	NA	0.041 J	NA																
Heptachlor	ug/L	0.0038	--	--	NA	0.5 U	0.7 U	5 U	NA	0.013 J	NA																
Heptachlor Epoxide	ug/L	0.0038	--	--	NA	0.5 U	0.7 U	5 U	NA	0.05 U	NA																
Methoxychlor	ug/L	0.03	--	--	NA	5 U	7 U	50 U	NA	0.5 U	NA																
Toxaphene	ug/L	0.0002	--	--	NA	10 U	10 U	100 U	NA	1 U	NA																
<strong>Total Metals</strong>																											
Aluminum	ug/L	87	--	--	NA	100 U	360	NA																			
Arsenic	ug/L	150	--	--	NA	16	35	NA																			
Cadmium	ug/L	0.72	--	--	NA	10 U	10 U	NA																			
Chromium	ug/L	74	--	--	NA	NA	NA	NA	15 U	NA	NA	NA	NA	NA	15 U	15 U	NA										
Chromium-Hexavalent	ug/L	11	--	--	NA																						
Iron	ug/L	1000	--	--	NA	8800	17000	NA																			
Lead	ug/L	2.5	--	--	NA	5 U	10 U	NA																			
Mercury	ug/L	0.77	--	--	NA	0.2 U	0.3	NA																			
Nickel	ug/L	52	--	--	NA	40 U	40 U	NA																			
Zinc	ug/L	120	--	--	NA	43	430	NA																			
<strong>Dissolved Metals</strong>																											
Aluminum	ug/L	87	--	--	NA	100 U	NA	NA	NA	NA	120	NA															
Arsenic	ug/L	150	--	--	NA	8	NA																				
Cadmium	ug/L	0.72	--	--	NA	10 U	NA																				
Chromium	ug/L	74	--	--	15 U	15 U	15 U	15 U	NA	15 U	15 U	NA	15 U	NA	10 U	NA	NA	NA	NA	NA							
Chromium-Hexavalent	ug/L	11	--	--	NA																						
Iron	ug/L	1000	--	--	NA	5500	NA	NA	NA	NA	15000	NA	NA														
Lead	ug/L	2.5	--	--	NA	5 U	NA																				
Mercury	ug/L	0.77	--	--	NA	0.2 U	NA																				
Nickel	ug/L	52	--	--	NA	40 U	NA																				
Zinc	ug/L	120	--	--	NA	55	NA																				
<strong>General Chemistry</strong>																											
Ammonia	mg/L	--	0.99	1.9	NA																						
Chloride	mg/L	230	--	--	240	88	79	66	73	48	NA	NA	NA	36	38	49	NA										
Cyanide	mg/L	0.0052	--	--	NA	0.024	NA																				
Nitrogen, As Ammonia	mg/L	--	0.99	1.9	4.7	17	12	14	12	12	8.4	9.3	NA	100	NA	11	NA	NA	9.6	15	9.2	9.8	5.4	4.7	4.6	5	
<strong>Dissolved General Chemistry</strong>																											
Chloride	mg/L	230	--	--	NA	28.9	NA																				
Nitrogen, As Ammonia	mg/L	--	0.99	1.9	NA	4.99	NA																				

Color - Standard Exceeded; Bold - Detected; U - Not Detected; -- No Standard  
J - Estimated; R - Rejected; NA - Not Analyzed

**Attachment B**  
**Groundwater Analytical Results Compared to NRWQC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**  
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Sample Location					IW-11 (cont.)						IW-12																
Sample Date					12/21/05	01/18/06	02/17/06	03/15/06	04/20/06	05/10/06	12/08/88	05/01/89	11/01/89	05/01/90	11/21/90	11/27/90	11/28/90	12/21/90	12/18/96	01/24/97	03/16/05	04/19/05	05/18/05	06/15/05	08/17/05	09/21/05	
Sample Type					N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
Sample ID	Units	NRWQC	Ammonia (30°C, pH 7)	Ammonia (20°C, pH 7)	IW-11-20051221	IW-11-20060118	IW-11-20060217	IW-11-20060315	IW-11-20060420	IW-12-19881208	IW-12-19890501	IW-12-19891101	IW-12-19900501	IW-12-19901121	IW-12-19901127	IW-12-19901128	IW-12-19901221	IW-12-19961218	IW-12-19970124	IW-12-20050316	IW-12-20050419	IW-12-20050518	IW-12-20050615	IW-12-20050817	IW-12-20050921		
<b>Semivolatiles</b>																											
Pentachlorophenol	ug/L	15	--	--	NA	50 U	NA	100 U	NA	NA	NA	NA	NA	NA													
<b>Pesticides/PCBs</b>																											
4,4'-DDT	ug/L	0.001	--	--	NA	0.1 U	NA	NA	NA	NA	NA	NA															
Dieldrin	ug/L	0.056	--	--	NA	0.1 U	NA	NA	NA	NA	NA	NA															
Endosulfan I	ug/L	0.056	--	--	NA	0.05 U	NA	NA	NA	NA	NA	NA															
Endosulfan II	ug/L	0.056	--	--	NA	0.1 U	NA	NA	NA	NA	NA	NA															
Endrin	ug/L	0.036	--	--	NA	0.1 U	NA	NA	NA	NA	NA	NA															
Heptachlor	ug/L	0.0038	--	--	NA	0.05 U	NA	NA	NA	NA	NA	NA															
Heptachlor Epoxide	ug/L	0.0038	--	--	NA	0.05 U	NA	NA	NA	NA	NA	NA															
Methoxychlor	ug/L	0.03	--	--	NA	0.5 U	NA	NA	NA	NA	NA	NA															
Toxaphene	ug/L	0.0002	--	--	NA	1 U	NA	NA	NA	NA	NA	NA															
<b>Total Metals</b>																											
Aluminum	ug/L	87	--	--	NA	NA																					
Arsenic	ug/L	150	--	--	NA	NA																					
Cadmium	ug/L	0.72	--	--	NA	NA																					
Chromium	ug/L	74	--	--	NA	15 U	NA	NA																			
Chromium-Hexavalent	ug/L	11	--	--	NA	NA																					
Iron	ug/L	1000	--	--	NA	NA																					
Lead	ug/L	2.5	--	--	NA	NA																					
Mercury	ug/L	0.77	--	--	NA	NA																					
Nickel	ug/L	52	--	--	NA	NA																					
Zinc	ug/L	120	--	--	NA	NA																					
<b>Dissolved Metals</b>																											
Aluminum	ug/L	87	--	--	NA	100 U	NA	NA																			
Arsenic	ug/L	150	--	--	NA	NA																					
Cadmium	ug/L	0.72	--	--	NA	NA																					
Chromium	ug/L	74	--	--	NA	15 U	15 U	NA	15 U	15 U	NA	NA	NA	NA	NA	NA	NA										
Chromium-Hexavalent	ug/L	11	--	--	NA	NA																					
Iron	ug/L	1000	--	--	NA	NA																					
Lead	ug/L	2.5	--	--	NA	NA																					
Mercury	ug/L	0.77	--	--	NA	NA																					
Nickel	ug/L	52	--	--	NA	NA																					
Zinc	ug/L	120	--	--	NA	NA																					
<b>General Chemistry</b>																											
Ammonia	mg/L	--	0.99	1.9	NA	NA																					
Chloride	mg/L	230	--	--	NA	NA	NA	NA	NA	NA	100	110	68	73	60	NA	NA										
Cyanide	mg/L	0.0052	--	--	NA	NA																					
Nitrogen, As Ammonia	mg/L	--	0.99	1.9	7.3	10	9.2	6.2	4.9	4	18	11	8.6	5.6	5.9	5.8	6.2	NA	NA	NA	2.5	2.8	2.5	2.7	2.1	1.9	
<b>Dissolved General Chemistry</b>																											
Chloride	mg/L	230	--	--	NA	NA																					
Nitrogen, As Ammonia	mg/L	--	0.99	1.9	NA	3.8	NA	NA	NA	NA	NA	NA															

Color - Standard Exceeded; Bold - Detected; U - Not Detected; -- No Standard  
J - Estimated; R - Rejected; NA - Not Analyzed

**Attachment B**  
**Groundwater Analytical Results Compared to NRWQC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**  
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Color - Standard Exceeded; Bold - Detected; U - Not Detected; -- No Standard  
J - Estimated; R - Rejected; NA - Not Analyzed

**Attachment B**  
**Groundwater Analytical Results Compared to NRWC - All Results**  
**Olin Chemical, Wilmington, Massachusetts**  
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Sample Location		IW-13 (cont.)																	
Sample Date																			
Sample Type				N	N	N	N	N	N	N	N	N	N	N	N	N	N		
Sample ID	Units	NRWC	Ammonia (30°C, pH 7)	Ammonia (20°C, pH 7)	IW-13-20050518	IW-13-20050615	IW-13-20050817	IW-13-20050921	IW-13-20051019	IW-13-20051116	IW-13-20051221	IW-13-20060118	IW-13-20060217	IW-13-20060315	IW-13-20060420	IW-13-20060510	P5-20030403	P5-20030523	P5-20030929
<b>Semivolatiles</b>																			
Pentachlorophenol	ug/L	15	--	--	NA	5000 U	5000 U	25000 U											
<b>Pesticides/PCBs</b>																			
4,4'-DDT	ug/L	0.001	--	--	NA	NA	NA												
Dieldrin	ug/L	0.056	--	--	NA	NA	NA												
Endosulfan I	ug/L	0.056	--	--	NA	NA	NA												
Endosulfan II	ug/L	0.056	--	--	NA	NA	NA												
Endrin	ug/L	0.036	--	--	NA	NA	NA												
Heptachlor	ug/L	0.0038	--	--	NA	NA	NA												
Heptachlor Epoxide	ug/L	0.0038	--	--	NA	NA	NA												
Methoxychlor	ug/L	0.03	--	--	NA	NA	NA												
Toxaphene	ug/L	0.0002	--	--	NA	NA	NA												
<b>Total Metals</b>																			
Aluminum	ug/L	87	--	--	NA	NA	NA												
Arsenic	ug/L	150	--	--	NA	NA	NA												
Cadmium	ug/L	0.72	--	--	NA	NA	NA												
Chromium	ug/L	74	--	--	NA	NA	NA												
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA												
Iron	ug/L	1000	--	--	NA	NA	NA												
Lead	ug/L	2.5	--	--	NA	NA	NA												
Mercury	ug/L	0.77	--	--	NA	NA	NA												
Nickel	ug/L	52	--	--	NA	NA	NA												
Zinc	ug/L	120	--	--	NA	NA	NA												
<b>Dissolved Metals</b>																			
Aluminum	ug/L	87	--	--	NA	NA	NA												
Arsenic	ug/L	150	--	--	NA	NA	NA												
Cadmium	ug/L	0.72	--	--	NA	NA	NA												
Chromium	ug/L	74	--	--	NA	NA	NA												
Chromium-Hexavalent	ug/L	11	--	--	NA	NA	NA												
Iron	ug/L	1000	--	--	NA	NA	NA												
Lead	ug/L	2.5	--	--	NA	NA	NA												
Mercury	ug/L	0.77	--	--	NA	NA	NA												
Nickel	ug/L	52	--	--	NA	NA	NA												
Zinc	ug/L	120	--	--	NA	NA	NA												
<b>General Chemistry</b>																			
Ammonia	mg/L	--	0.99	1.9	NA	NA	NA												
Chloride	mg/L	230	--	--	NA	NA	NA												
Cyanide	mg/L	0.0052	--	--	NA	NA	NA												
Nitrogen, As Ammonia	mg/L	--	0.99	1.9	34	25	20	25	27	29	26	25	32	35	33	29	NA	NA	
<b>Dissolved General Chemistry</b>																			
Chloride	mg/L	230	--	--	NA	NA	NA												
Nitrogen, As Ammonia	mg/L	--	0.99	1.9	NA	NA	NA												